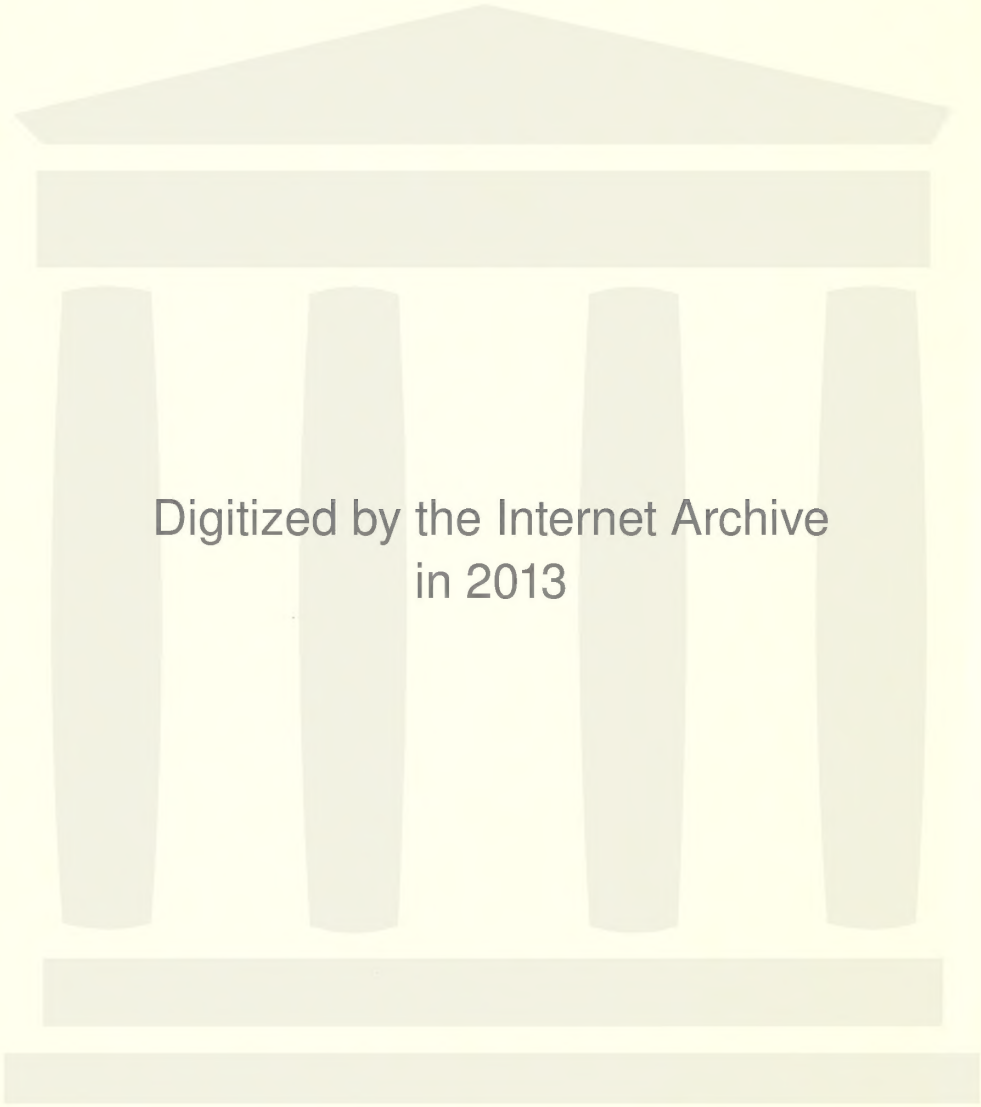
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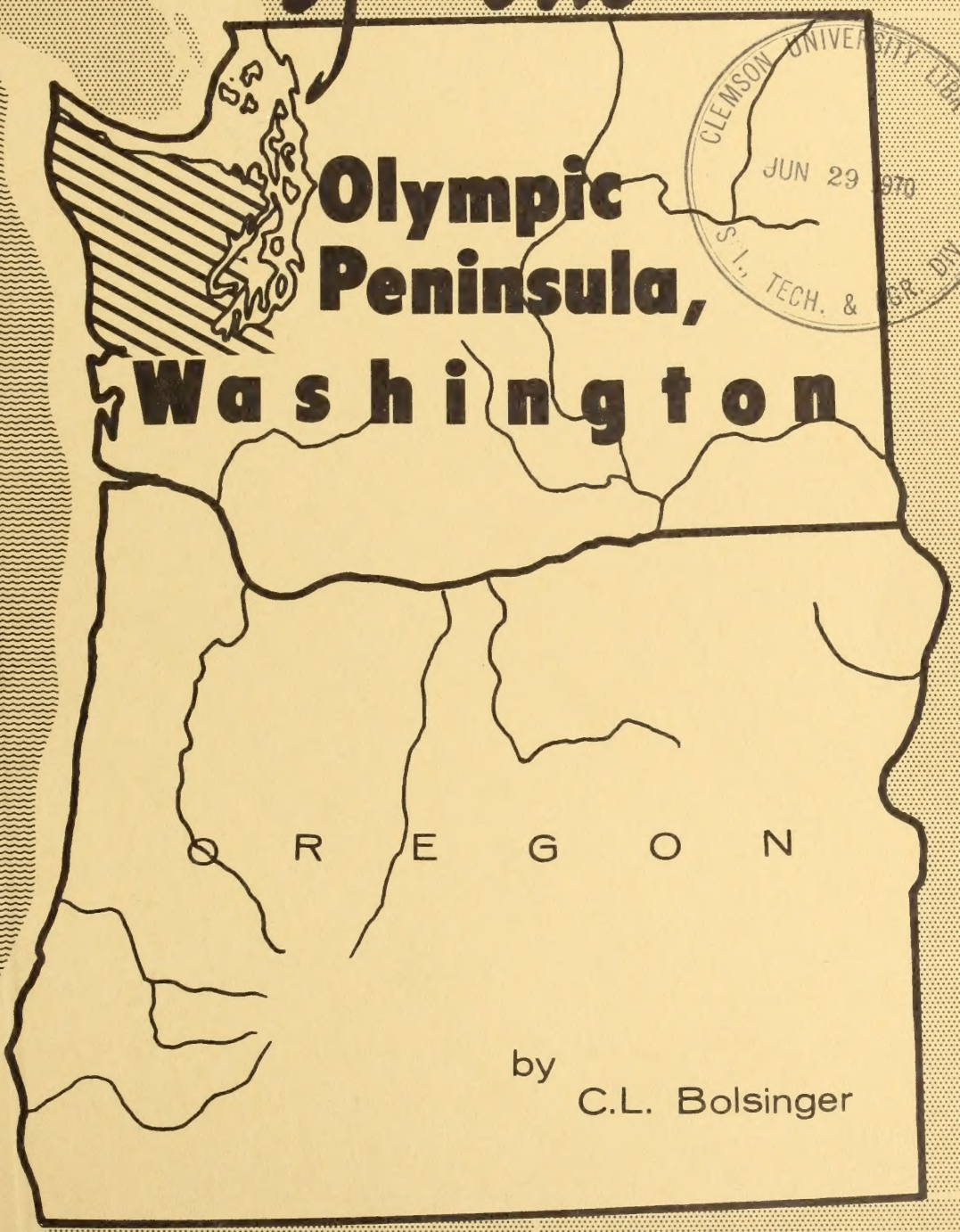
The Timber Resources of the Olympic Peninsula, Washington



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FOREST AND RANGE EXPERIMENT STATION
FOREST SERVICE · U.S. DEPARTMENT OF AGRICULTURE
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Many public agencies, including some of those mentioned above, and several private timber companies provided maps and helpful information on access to forest lands, as well as general information related to forest management activities on the Olympic Peninsula.

Preface

This report summarizes the findings of the fourth inventory of the forests in Clallam, Jefferson, Grays Harbor, Mason, and Thurston Counties in Washington. Fieldwork on lands outside the National Forests was completed during the summer of 1965. Fieldwork for the Olympic National Forest was completed in 1963, and for the Snoqualmie National Forest, a small portion of which lies in southeast Thurston County, in 1965. Previous inventories of these five counties were completed as follows:

County	First inventory	Second inventory	Third inventory
Clallam	1932	1939	1960
Grays Harbor	1932	1937	1951
Jefferson	1932	1939-40	1960
Mason	1932	1940	1951
Thurston	1932	1939	1954

This inventory was conducted by the Forest Survey, a nationwide project of the Forest Service authorized by the McSweeney-McNary Forest Research Act of 1928 and subsequent amendments. The purposes of the Forest Survey are to obtain comprehensive information on timber resources, including the extent and condition of forest lands, the amount and kind of timber growing on these lands, the rate of forest growth and depletion, the amount of timber cut, and probable future trends in timber requirements, and to analyze and make available survey information needed to formulate forest policies and programs. Resurveys are made periodically to update basic information.

The Forest Survey is conducted in all nine forest regions of the United States by the USDA Forest Service Experiment Stations. The Pacific Northwest Forest and Range Experiment Station at Portland, Oregon, is responsible for the States of Washington, Oregon, California, Alaska, and Hawaii.

Summary

The fourth inventory of the timber resources of the Olympic Peninsula shows a total of 3,105,000 acres of commercial forest land and 81,464 million board feet (International 1/4-inch scale) of sawtimber volume. Total timber volume has remained about the same for the past 12 years, and cut and growth currently are nearly in balance.

Compared with the Douglas-fir region as a whole, less of the forest in the Olympic Peninsula is in a poorly stocked condition, and a greater proportion is in fast-growing young conifer timber. The generally good condition of the forest reflects the high growth potential of the forest land and the relative ease with which lands restock. Most of the present young sawtimber stands originated after logging or burning in the timber boom period of the late 1800's and early 1900's, or as a result of the February 1921 windstorm. Although most of these young-growth stands originated by chance, forest protection the past few decades has been important in their survival and development.

Although the forest is in generally good condition, there are some problems. Relatively large areas of high-site conifer lands are not producing as much as they could because of low stocking, overstocking, or predominance of low-quality trees. Several hundred thousand acres of forest land occupied by hardwoods could be growing more valuable conifer timber. A considerable volume of dead hemlock and Douglas-fir timber, much of which occurs in fairly heavy per-acre concentration, is being lost annually. Western redcedar, the basic resource for the important shake and shingle industry on the Peninsula, is diminishing and at the present rate of cutting will be gone in 25 years or less. A problem facing the timber industry is the loss of commercial forest land. A substantial area has been lost to roads and powerlines, urban and agricultural clearing, and recreational development. In the eastern part of the Peninsula, future losses due to recreational and real estate development may exceed 200,000 acres by the year 2000. Other areas may also be affected. If softwood timber production is to remain the same or be increased, more intensive management of remaining lands will be necessary.

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Introduction

The Olympic Peninsula is one of the outstanding tree-growing areas on the North American Continent, and timber has been a primary factor in its development. In the early 1850's, waterpowered sawmills were operating in what is now Jefferson and Mason Counties; and in 1853, the year Washington Territory was created, Pope and Talbot, an eastern concern, set up sawmill operations at Port Gamble on the east bank of Hood Canal. Demands created by the California gold rush and the growth and repeated burning of San Francisco sent lumber prices soaring; as a result, the great Douglas-fir stands in the lowlands of the Peninsula's east side fell at an accelerated rate. Lumberjacks moved steadily inland from tidewater, first yarding the massive logs by ox team and later by steam donkey. A number of logging railroads began deep penetration into the woods. Among these were the Satsop, the Mason County Central, and the more successful Puget Sound and Grays Harbor Railroad, the latter managed by Sol Simpson primarily to supply Mason County logs to the Port Blakely Mill Company on Puget Sound (Simpson and Port Blakely are two names still prominent in the Olympic Peninsula). In the 1880's and 1890's, several hundred million board feet of timber were cut in Mason County, and in eastern

Figure 1. — The city of Shelton, in Mason County, is one of the oldest timber towns in the Northwest and is still an important forest industry center.

Clallam and Jefferson Counties near Discovery Bay, Port Townsend, and Port Ludlow.

The lumber boom intensified, reaching a peak shortly after the end of World War I. For three decades, logging was the dominant activity from Port Angeles to Shelton in eastern Clallam and Jefferson Counties and Mason County. By the late 1920's, the accessible old-growth Douglas-fir was nearly gone from eastern Clallam and Jefferson Counties, the loggers having cut back to the steep flanks of the mountains; and the lumber industry declined rapidly. In its shadow, however, grew the pulp and paper industry, still prominent today and one of the main supporting payrolls in Port Angeles and Port Townsend. Mason County also had its low period during the 1920's and 1930's, but today it is an important and stable timber supply area (fig. 1).

Thurston County, at the extreme southern tip of Puget Sound, was an important timber supply area in the past; it is less so today, but still contributes some to the total harvest. Of more importance are its mills and overseas harbor which handle logs and other forest products originating in many western Washington counties.

At Grays Harbor in the southwestern corner of the Peninsula, the first sawmills were built in the 1880's. The towns of Aberdeen and Hoquiam grew with the burgeoning lumber industry. Initially, Grays Harbor lumber was manufactured pimarily for local use and to supply the southern California building boom. After the opening of the Panama Canal in 1914, Grays Harbor became an important world port in the lumber trade. From 1884 to 1924, over 20 billion board feet were cut from the forests of present Grays Harbor County. From 1924 to 1929, the cut exceeded a billion board feet per year, the primary species being Douglas-fir, Sitka spruce, and western redcedar, though even at this early period some hemlock lumber was being manufactured. The easily accessible old-growth Douglas-fir was becoming scarce when the Depression crippled the Nation and these two factors, combined with the related 1926-27 collapse of the California building boom — due in part to the rising postwar prices — caused Grays Harbor lumber production to drop to one-quarter billion board feet in 1932. For years, lumber production never rose above one-half billion feet annually (in 1938, production was only 194 million), although the decline in lumbering was partly compensated for by the growth of the veneer and plywood and pulp and paper industries. For many years, Grays Harbor County was a semidepressed area, but now, as in the other Peninsula counties, economic activity is on the upswing. Though in part due to general regional and national economic well-being, Grays Harbor's recent growth is also a reflection of its productive forests and of the conversion of the forest industry from old-growth Douglas-fir lumber to a diversified industry using a greater range of sizes and species of trees in a variety of products.

After more than a century of logging, Olympic Peninsula timber is still of major importance to the local and State economy and to the Nation's paper-using and homebuilding industries (fig. 2). Employment by the forest industries is about 15,000 persons or 40 percent of total industrial employment reported in the five-county area (Employment Security Department 1966). In addition to reported employment, there are many nonreporting independent timber workers on the Peninsula including cedar cutters and many family operations. In addition to supporting the local economy, a substantial volume of Olympic Peninsula logs is hauled to mills on Puget Sound and in Lewis and Pacific Counties to the south and southeast, thus contributing to employment in these areas.

Compared with the Douglas-fir region as a whole, the Olympic Peninsula has had a rather long history of forest protection and management. In some areas, the present timber stands represent the third crop since settlement in the 1800's. The first private tree farm in the United States — the Clemons Tree Farm — was established at Montesano in Grays Harbor County in 1941, and two cooperative U. S. Forest Service-private industry experimental forests on private lands have been in existence for years to study the management of second-growth hemlock and Douglas-fir timber. At least two private timber companies and the State Department of

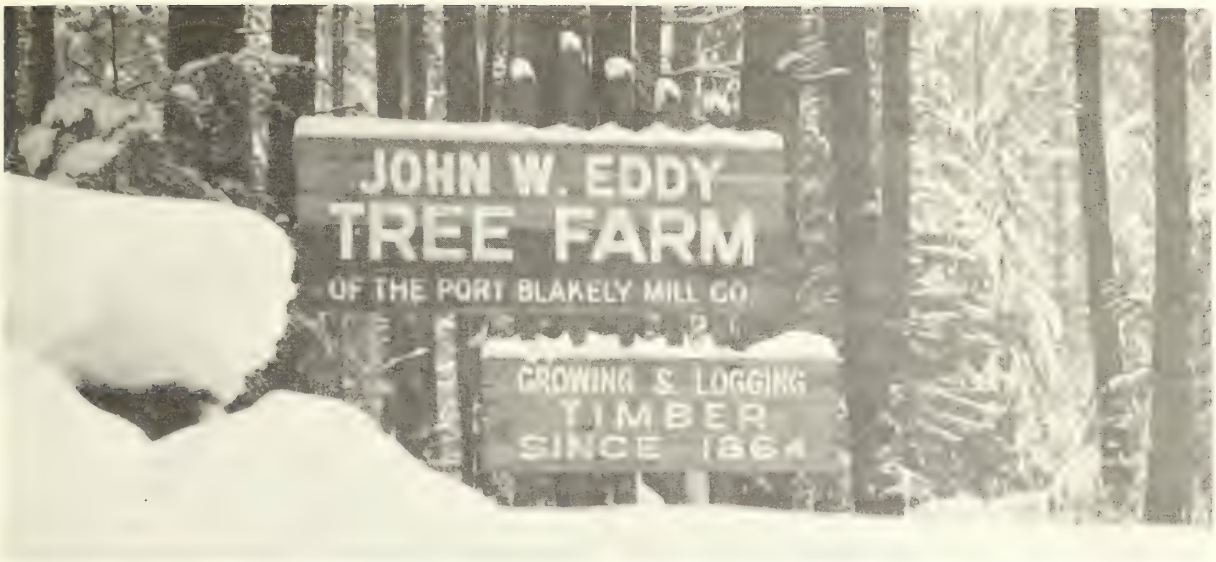

Figure 2. — The Olympic Peninsula has had a long and active logging and tree-growing history. This is one of many private tree farms on which continuous tree crops are being grown.

Natural Resources have fertilized second-growth timber stands, and experimental programs in tree genetics are currently being conducted.

Growth and cut are presently about equal on the Olympic Peninsula, a situation that exists in few areas in the Douglas-fir region and contrasts sharply with past conditions. In 1938, cut exceeded growth by over 800 percent on the Olympic Peninsula; yet the cut was only 41 percent greater than the current timber harvest (1.7 billion board feet in 1938 compared with 1.2 billion now). Although the cut-growth relationship has changed for the better, there has also been a change in the species distribution of the cut. From 1925 to 1933, over 60 percent of the timber harvest was Douglas-fir and less than 20 percent was hemlock. In 1965, 22 percent was Douglas-fir and about 47 percent of the cut was hemlock.

The increase in growth from about 189 million board feet a year in 1938 to 1,182 million now is the result of forest protection since 1938, replacing static old-growth stands with fast-growing young stands, and the restocking of large areas that were cut over and burned in the early logging days. In 1938, the area in old nonstocked burns and cutover areas totaled 356,000 acres. The current inventory shows only 45,000 acres of nonstocked forest land, and this includes recently logged lands which were not included in the 1938 nonstocked acreage.[1]

In spite of the small acreage of nonstocked forest, some areas are not producing as much as they could because of low stocking, or overstocking, or predominance of low-quality trees. Several hundred thousand acres of forest land, mostly in private ownership, now occupied by hardwoods, could be growing a greater volume of more valuable conifer timber.

Though an important timber area, the Olympic Peninsula is probably better known in other parts of the world for its superb scenery. The 897,000-acre Olympic National Park (fig. 3), parts of which lie in four of the five Peninsula counties, attracts campers, fishermen, hikers, mountain climbers, and sightseers from all over the United States and from many foreign countries. The annual number of visitors has increased from 92,000 in 1940 to over 2 million in 1968.

The Olympic National Forest nearly encircles the National Park. Though National Forest lands are managed for timber produc-

[1] *The exact differences in volume, growth, and area between these inventories cannot be determined because of differences in standards and definitions.*

tion, they are also used for other purposes such as recreation, watershed, and game range. Many weekend visitors to the Olympic Peninsula camp in the National Forest or travel through it on their way to the Park. National Forest land managers take this into account in their timber management plans, in some areas modifying the harvesting methods and volume of timber cut accordingly. Recreational use of the Olympic National Forest has been increasing — from about 18,000 visitors in 1940 to over 800,000 in 1968. Greater recreational use of all forest lands is predicted.

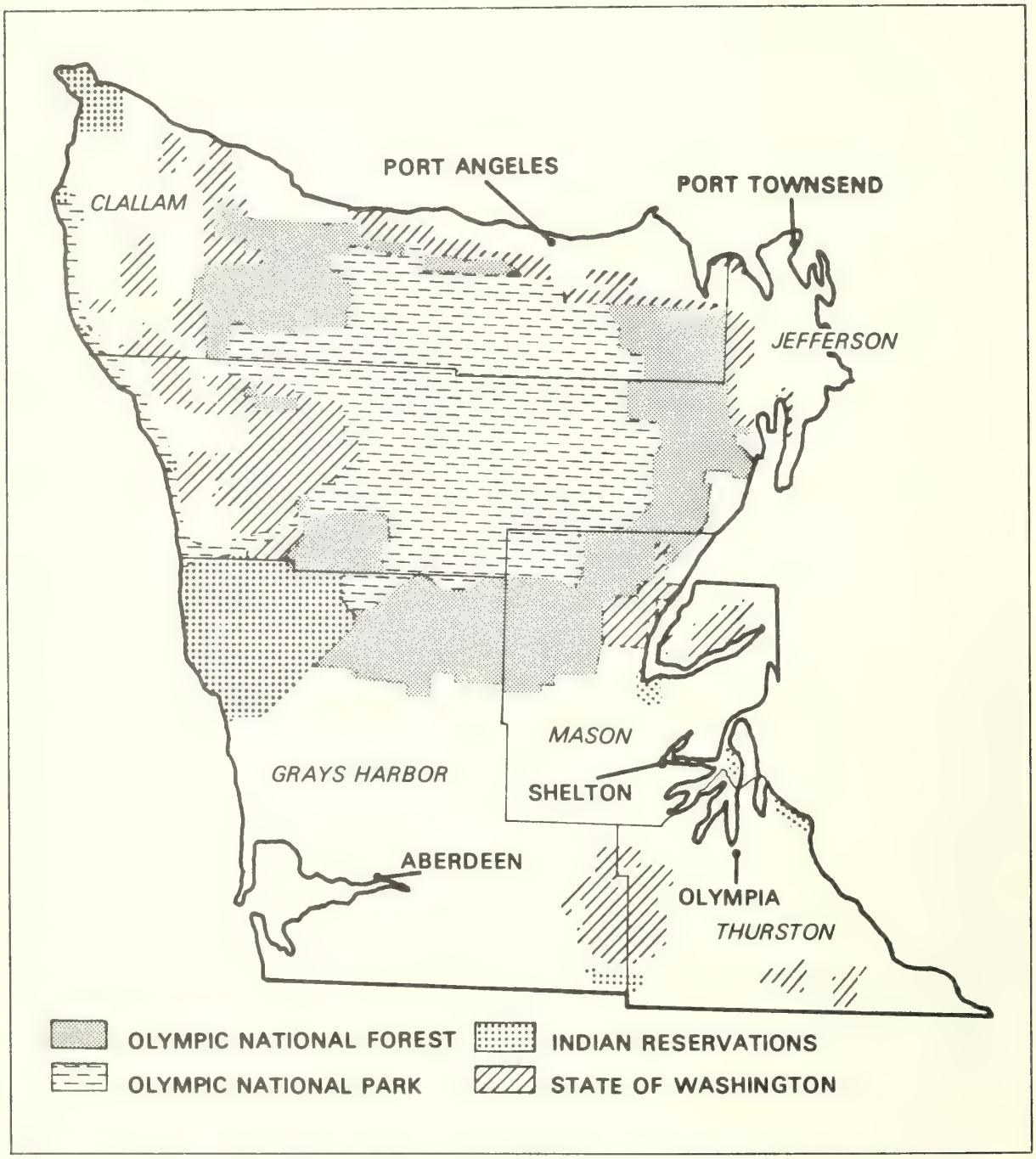

Figure 3. — Map of Olympic Peninsula showing generalized boundaries of public lands.

The Timber Resource

Commercial Forest Land Area Exceeds 3 Million Acres

The Olympic Peninsula has a total land area of 4,577,000 acres, of which 3,105,000 acres or 68 percent is commercial forest land. Another 518,000 acres of productive forest land are reserved in the Olympic National Park, in the Quinault Natural Area in the Olympic National Forest, and in a few small State and county parks. Christmas tree lands, also included as productive reserved, total 35,000 acres (fig. 4). Unproductive forest land totals 372,000 acres, and this includes subalpine and steep rocky areas, swampy sites, and other areas incapable of producing timber crops.

Sawtimber Volume Exceeds 80 Billion Board Feet

Total sawtimber volume on commercial forest land is 81.5 billion board feet, International 1/4-inch scale; 77.9 billion or 96 percent of this is in softwood species and 3.6 billion or 4 percent is in hardwood species. Growing-stock volume totals 15.3 billion cubic feet; 14.0 billion or 92 percent of this is in softwood species and 1.3 billion or 8 percent is in hardwood species. Hardwood cubic-foot volume is proportionately greater than

Figure 4. — This truckload of Mason County Christmas trees is enroute to a processing yard near Shelton. Christmas trees are being grown on 35,000 acres of forest land on the Olympic Peninsula.

hardwood board-foot volume because of the relatively large number of poletimber-size hardwood trees.

Commercial Forest Land Area Decreasing, but Volume Remaining the Same

Although the commercial forest land base shown by the current inventory cannot be compared precisely with previous inventories because of changing standards, there is no doubt that the commercial forest land base is decreasing. A special study was made in which given areas on 1951-53 aerial photographs were compared with 1962-64 photographs. The decrease of commercial forest land on the Olympic Peninsula was estimated to be about 3.1 percent for an annual rate of about 0.3 percent. For the most part, the loss has been in the eastern portion of the Peninsula. The major losses are to: road and powerline building and widening, commercial and residential development, land clearing for agricultural purposes, and in Mason County, conversion of timberlands to Christmas tree production areas.

Despite the decrease in commercial forest land area, cubic-foot volume of growing stock has increased slightly since 1953. Most of the increase has been in hardwood trees; softwood volume has remained relatively static. These trends — shown in table 1 — were developed by projecting the current inventory backward in time to 1953 by use of stand projection models which took into account changes in commercial forest land area, historical cutting experience, and current growth and mortality rates.

Table 1. — Comparison of net volumes of growing stock and sawtimber on commercial forest land by softwoods and hardwoods, Olympic Peninsula, Washington, 1953, 1960, and 1965

Year	Growing stock			Sawtimber		
	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million cubic feet			*Million board feet*[1]		
1953	14,452	13,848	604	82,591	80,910	1,681
1960	14,851	13,934	917	81,927	79,370	2,557
1965	15,254	13,964	1,290	81,464	77,881	3,583

[1] *International 1/4-inch scale.*

Since 1953, there has been an increase in numbers of softwood trees less than 24 inches in diameter and a decrease in numbers of softwood trees 24 inches and larger. Although detailed data on hardwood trends are not available, it appears the number of hardwood trees has about doubled in most diameter classes.

Eighty Percent of Commercial Forest Land Is in Public and Forest Industry Ownership

On the Olympic Peninsula, 1,342,000 acres or about 43 percent of the commercial forest land is owned by Federal, State, and county governments. Much of this is in fairly large consolidated blocks, such as the Olympic National Forest, the Quinault Indian Reservation, and the State of Washington's Capitol Forest in eastern Grays Harbor and western Thurston Counties and Sustained-Yield Unit Number 1 in western Jefferson County (fig. 3).

Forest industry ownership totals 1,139,000 acres or 37 percent of the total commercial forest land area. Much of this is in large blocks, a pattern becoming even more prevalent as timber companies consolidate their holdings.

Miscellaneous private ownership totals 561,000 acres or 18 percent. A considerable area in this class is currently being managed for continuous timber production, although some acreage is owned by real estate and development companies and others who have no intention of managing their lands for timber production. Much of the miscellaneous privately owned land is in relatively large parcels, especially in the western part of the Peninsula.

Whether or not the miscellaneous private lands are kept in timber production will be important to the future of the timber industry on the Peninsula. A decade ago, these lands were considered to be suited only to timber production because the terrain is generally unsuitable for agriculture or grazing and much of the prime scenic land had already been set aside in the National Park. Now, however, with increased demands on the land from outdoor recreationists and commercial and residential developers and because these miscellaneous private owners do not have a commitment to support large investments in forest products mills, a substantial portion of the lands eventually may be diverted from timber production.

Farmers hold 63,000 acres or only 2 percent of the commercial forest land on the Olympic Peninsula. Most of these lands are located in northeast Clallam and eastern Jefferson Counties, along the Chehalis River in Grays Harbor County, and in the lower elevations throughout Thurston County. These lands are in relatively small parcels and are often in poorly stocked condition with hardwoods predominating. Though of little importance to the future of the forest industry, timber from these lands has been contributing to the total production. At least one timber company has offered forestry consulting advice to small-woodlot owners with the idea of getting them to increase production on their lands and thus informally assure the company's mills of a continuous supply of logs from this particular source.

A relatively large proportion of the Peninsula's commercial forest land is in large company and public ownership and a small proportion in farmer ownership. In the Douglas-fir region as a whole, forest industry owns about 28 percent and farmers 10 percent of the commercial forest land (Pacific Northwest Forest and Range Experiment Station 1965) compared with 37 percent and 2 percent, respectively, on the Peninsula. The overall ownership pattern is significant in that large and corporate ownership is conducive to overall efficiency in terms of timber production per acre. The many large and well-established firms with modern mills and extensive acreages dedicated to timber production indicate a fairly stable timber industry.

Hemlock Is Most Extensive Forest Type; Douglas-fir Second

Western hemlock type occupies 1,211,000 acres or 39 percent of the commercial forest land area. The hemlock stands occur at all elevations in the western part of the Peninsula and on the upper slopes of the mountains in the eastern portion. Douglas-fir type covers 913,000 acres or 29 percent of the commercial forest area and is located mostly in the eastern parts of the Peninsula, though scattered stands may be found along the streams and on some of the drier ridges and benches on the west side. Douglas-fir type is almost entirely absent from the extensive old-growth forest in western Jefferson County, though occasional Douglas-fir trees up to 100 inches or more in diameter and small groups of these large trees occur in the hemlock stands.

Many stands of hemlock in the Aberdeen-Hoquiam area now occupy sites that once supported Douglas-fir. Hemlock, a tolerant species, has always been present as a codominant associate or as an understory component of the forest. The Douglas-fir stands which attracted the early timbermen probably originated following some catastrophic disturbance centuries ago. In the early days, when the Douglas-fir was cut, the hemlock was often left, thus accelerating the natural successional trend toward a climax hemlock forest. On many of these sites, either Douglas-fir or hemlock can be grown successfully; but in the "hemlock belt" along the Pacific Coast, more fiber per acre usually can be grown with hemlock than with Douglas-fir within the range of rotation ages planned by forest managers. Economics and landowner objectives may dictate one species over the other, and

future tree genetics work and fertilization could possibly change the comparative yields of these two species.

Currently, much of the commercial forest land on the west side of the Peninsula is being managed for hemlock production, though Douglas-fir and, in a few cases, true firs are being planted on many of the cutover areas, especially in the foothills and mountains away from the coast. In the eastern and less humid portions of the Peninsula, Douglas-fir is the primary species considered in forest management almost to the exclusion of any others.

Young-Growth Stands Occupy Three-Fourths of the Commercial Forest Land Area

Stands under 100 years of age occupy about 2,313,000 acres or three-fourths of the commercial forest land area (fig. 5). Stand age distribution is fairly even in the 0- to 50-year age groups, but from 50 years up there are gaps. About 37 percent of the area and 54 percent of the cubic-foot volume in even-aged stands under 100 years are in the 30- and 40-year age groups. A sizable portion of this is in the western part of the Peninsula on lands where older stands were devastated by the February 1921 windstorm which blew down an estimated 4.5 billion board feet of timber. These young-growth stands are generally well stocked and in some areas make up the only stands, aside from seedling-sapling stands on recent cutovers, that are less than 200 years old. Some of these young stands contain as much net volume per acre as the defective old-growth stands in the same general area.

About 997,000 acres or 43 percent of the stands under 100 years of age is in forest industry ownership; and 571,000 acres or 25 percent is in the farmer and miscellaneous group. National Forest owns 203,000 acres or 9 percent of the young growth; 542,000 acres or 23 percent is in other public holdings.

Over 60 Percent of Sawtimber Volume Is on Public Lands

National Forest lands contain 25,410 million board feet (International 1/4-inch scale), or 31 percent of the total sawtimber volume on the Peninsula. Other public lands, including State, county, military, and Indian lands,

Figure 5. — Three-fourths of the commercial forest land in the Olympic Peninsula supports young-growth timber. This well-stocked hemlock stand occupies a clearcut patch on the Olympic National Forest in the Humptulips River drainage in Grays Harbor County.

contain 24,707 million board feet, or 30 percent of the total. Forest industry lands contain 22,553 million board feet or 28 percent of the total, and the farmer and miscellaneous lands contain 8,794 million board feet or 11 percent.

Nearly all the National Forest volume is in softwood species, whereas the sawtimber volume on private lands and to some extent on other public lands includes substantial amounts of hardwoods. The National Forest has little hardwood volume because its lands are on the higher slopes generally above the hardwood zone, and these lands have not had the long history of logging and burning characteristic of much of the private lands on the Peninsula. In the past, many stands of red alder have come in on conifer sites after logging and burning.

National Forest Holds Most of Large Douglas-fir Sawtimber

Although both Douglas-fir and hemlock types are well distributed across ownership classes, most of the old-growth Douglas-fir is in National Forest ownership. About half of the Douglas-fir volume in trees 21 inches and larger and three-fourths of the volume in trees 29 inches and larger are on National Forest land. Old-growth hemlock is fairly well distributed among National Forest, other public, and forest industry ownership.

Most private timber companies are planning to have liquidated their old-growth timber within a few years to a decade or two. Old-growth timber on other public lands will last somewhat longer. National Forest lands may someday be the primary source of old-growth timber.

Half of the Softwood Sawtimber Volume Is in Trees 29.0 Inches and Larger

For all softwood species, 55,442 million board feet (International 1/4-inch scale) or 71 percent is in trees 21.0 inches and larger; and 38,479 million or 49 percent is in trees 29.0 inches and larger; 21,312 million board feet or 27 percent is in trees 39.0 inches and larger. About 64 percent of total sawtimber volume is in stands 100 years old or older.

Figure 6. — This Douglas-fir log was cut in the upper Wynoochee Valley on the Olympic National Forest. Large logs will make up a significant portion of the Olympic Peninsula timber supply for years to come.

Size distribution is a significant factor in the overall forest industry picture. Although young-growth timber is contributing to the total timber supply at an increasing rate and is reducing the size of the average log handled, a substantial resource of large material still exists and will make up a large part of the log supply for years to come (fig. 6). This means that a diversity of equipment will be needed by the industry to handle both large and small size logs. Some smaller mills on the Peninsula have completely converted to handling second-growth timber, and in some areas where the old growth has been cut out for some time, an occasional load of large logs has to be hauled a long distance to reach a mill that can handle large material. The recent development of chipping-and-sawing and other rigs that process logs as small as 4 to 6 inches has resulted in a ready market for small logs in most areas, a reversal of the situation that prevailed a few years ago.

Growth and Cut

Net Annual Growth Is 1.6 Billion Board Feet

Net annual growth of sawtimber on commercial forest land on the Olympic Peninsula is 1,610 million board feet, International 1/4-inch scale, about 2.0 percent of current inventory volume. Average net annual growth per acre for all ownerships is 519 board feet. Forty-two percent of the growth is Douglas-fir and 35 percent is hemlock. Hardwoods make up about 16 percent of the total board-foot growth.

Net annual growth of growing-stock trees is 349.6 million cubic feet or about 2.3 percent of inventory volume.

Growth Rates are High on Private Lands, Low on Public Lands

Although public sawtimber volume exceeds private sawtimber volume by 60 percent, net annual growth on private lands is nearly three times as much as on public lands — 1,204 million board feet compared with 406 million.

Table 2 shows per-acre volume, growth, and mortality by the four main ownership groups.

Table 2. — Annual per-acre volume, growth, and mortality by ownership group

Ownership	Inventory volume per acre	Gross growth per acre	Mortality per acre	Annual mortality as percent of gross growth	Net annual growth per acre
	Board feet[1]				*Board feet*[1]
National Forest	47,143	442	402	91	40
Other public	30,768	805	326	40	479
Forest industry	19,801	789	113	15	676
Farmer and miscellaneous private	14,093	739	43	6	696
All ownerships	26,236	723	204	28	519

[1] *International 1/4-inch scale.*

The above figures are averages over all age groups and do not necessarily indicate growth potential or degree of forest management; nor do they take into consideration the various management objectives of the different owners.

The low net annual growth rates on National Forest and other public lands reflect the higher proportions of these lands in old-growth stands, the impact of mortality in these stands, and the relatively small acreage in young-growth stands that are old enough to be putting on board-foot increment.

Only 76,000 acres or 14 percent of National Forest lands and 109,000 acres or 13 per-

cent of other public lands are stocked with stands 40 to 100 years old, the age span of maximum board-foot growth on most sites, whereas 234,000 acres or 21 percent of forest industry lands and 154,000 acres or 25 percent of farmer and miscellaneous private lands are stocked with 40 to 100-year-old stands. Growth rates on National Forest and other public lands will increase as the 484,000 acres of 1 to 40-year-old stands grow into the older age classes.

The farmer and miscellaneous private owner group has the highest annual growth rate, but over 20 percent of the growth is on hardwoods. Forest industry and other public lands, although having the highest gross growth, have lower net growth rates than farmer and miscellaneous lands because of mortality. Forest industry and other public owners also have the highest growth potential. The following tabulation shows average cubic-foot-growth capacity in fully stocked stands and percent of area capable of growing 165 or more cubic feet per acre per year (roughly equal to hemlock site III (Barnes 1962) or better and Douglas-fir site II (McArdle 1961) or better) by ownership groups:

Ownership	Average cubic-foot-growth capacity	Percent of ownership area capable of growing 165 or more cubic feet per acre per year
National Forest	139	31
Other public	155	41
Forest industry	160	45
Farmer and miscellaneous private	103	24
All ownerships	144	37

Growth and Cut Almost Balance

The forests of the Olympic Peninsula are currently growing about as fast as they are being cut. The average annual cut of live trees reported for 1961-65 was 1,181 million board feet, Scribner scale (about 1,540 million, International 1/4-inch scale). Net annual growth for the year 1965 is estimated to be 1,182 million board feet, Scribner scale (1,610 million, International 1/4-inch scale).

Ownership	Net growth	Cut
	(Million board feet, Scribner scale)	
Public	291	584
Private	891	597
Total	1,182	1,181

The imbalance of growth and cut on public lands is temporary, reflecting the large area of slow-growing, old-growth timber on the lands from which the timber cut is coming. A similar situation existed on private lands in 1933 — cut was over eight times as great as growth in the Grays Harbor and Willapa Harbor Districts (Keezer 1941). Growth rates should increase in the future as old-growth stands are replaced with well-stocked young-growth stands.

The present rate of cutting on private lands is substantially less than growth with a resultant buildup of inventory. This situation exists because some stands are too small by today's standards for cutting; some are being withheld from harvest because of mounting pressure to use forest land for nontimber purposes; and some are held by owners who for many different reasons have little interest in timber production.

Mortality and Salvable Dead Timber

Mortality Averages 204 Board Feet Per Acre

Average annual mortality on the Olympic Peninsula is 633.5 million board feet (International 1/4-inch scale), about 204 board feet per acre.

The mortality rate for hemlock, the species having greatest total live volume, is 0.95 percent of hemlock inventory volume. Douglas-fir, the second-most-plentiful species, has a mortality rate of only 0.40 percent. One reason for this difference is that much of the live hemlock sawtimber is in old-growth stands, whereas a large part of the live Douglas-fir volume is in young-growth stands.

The annual mortality is not all lost. From 1961 to 1965 inclusive, the reported average annual harvest of dead timber was 120 million board feet, Scribner scale (about 156 million, International 1/4-inch scale).

Salvable Dead Volume Totals 3 Billion Board Feet

Total Scribner board-foot volume of salvable dead timber is 3,130 million, only about 27 percent greater than the 2,460 million board feet of timber estimated to have died during the period 1961 to 1965. This seems to indicate there is no substantial long-term buildup of dead material. Because a large proportion of the mortality volume is hemlock, which deteriorates rapidly after death, rapid harvesting of this material is necessary if it is to be salvaged.

Tables 36 and 37 show net cubic- and Scribner board-foot volumes of salvable dead sawtimber by volume-per-acre and ownership classes and by volume-per-tree class and species group, respectively. Of the 3,130 million board feet of salvable dead timber, 1,257 million or 40 percent is in concentrations of 10,000 or more board feet per acre. About 509 million board feet or 16 percent is in concentrations of only 1 to 2,500 board feet per acre. The remaining 44 percent ranges in concentration from 2,500 to 10,000 board feet per acre.

About 55 percent of the salvable dead volume is outside the National Forest and 45 percent is on the National Forest. About 20 percent of the salvable dead volume outside the National Forest is in concentrations of 10,000 or more board feet per acre compared with 65 percent on the National Forest.

Hemlock accounts for about 41 percent of the salvable dead volume; Douglas-fir, 21 percent. Of the salvable dead volume, about 79 percent of the hemlock and 76 percent of the Douglas-fir are in trees which have a net volume of 500 or more board feet. About half of the salvable dead Douglas-fir is in trees having more than 2,500 board feet of salvable wood.

Condition of the Forest

Olympic Peninsula in Better Stocking Condition Than the Douglas-fir Region as a Whole

About 80 percent of the commercial forest land outside the National Forest on the Olympic Peninsula is 70 percent or more stocked with growing-stock trees, and only 7 percent is less than 40 percent stocked.[2] In the Douglas-fir region as a whole, only 57 percent of the commercial forest land is 70 percent or more stocked and the less-than-40-percent-stocked acreage totals 18 percent (Pacific Northwest Forest and Range Experiment Station 1965).

Nonstocked Areas Minimal

The total nonstocked area on all ownerships in the Olympic Peninsula is 45,000 acres or only 1.4 percent of the total commercial forest land area. This is only slightly more than the 36,000 acres that were clearcut in 1965, the year most of the field data were collected, indicating that logged areas are being restocked with a high degree of success.

Half of the Young-Growth Stands Contain 80 Percent or More of Yield Table Cubic-Foot Volume

Unthinned stands 30 to 100 years old were rated against normal yield table cubic-foot values for the appropriate species, site, and age (Barnes 1962; McArdle 1961; Worthington et al. 1960). About 350 plots were examined. The findings were:

1. One-third of the young-growth stands contain 100 percent or more of yield table cubic-foot volume.
2. One-half of these stands contain 80 percent or more of yield table cubic-foot volume.
3. Three-fourths contain 60 percent or more of yield table cubic-foot volume.

In general, the 30- and 40-year-old stands are close to full yield table production, but older stands fall short. Forty-year-old stands, for example, average 86 percent of normal; 70-year-old stands average 58 percent. This may be partly the result of forest management and fire protection during the past three or four decades.

Within most age groups, the stands on poorer sites are closer to yield table production than stands on better sites, possibly because density of natural reproduction is usually greater on poorer sites. Another possible factor is brush competition, which is more of a problem on better sites in many areas than on poorer sites. These data indicate that some highly productive lands are currently producing less than their potential as defined in normal yield tables.

About 70 percent of the young-growth Douglas-fir stands contain 80 percent or more of the yield table value, but less than 50 percent of the hemlock stands are at this level of production.

All of these factors suggest that hemlock stands and high site land will yield the greatest increase in future fiber production.

Old-Growth Stands Average 10,800 Cubic Feet Per Acre

The average net volume in stands 100 years and older in the Olympic Peninsula is 10,800 cubic feet per acre. Most of these stands would have considerably more volume except for defective portions of merchantable trees and cull trees (fig. 7). In addition, considerable volume has been lost to mortality, and many stands have brush-choked areas where trees could be growing. Productivity in future rotations will undoubtedly be greater. For example, on Douglas-fir site 150 land, 10,550 cubic feet can be grown in 60 years in fully

[2] *Data not available for National Forest lands.*

Figure 7. — Old-growth stands on the Olympic Peninsula contain many defective trees. This hollow hemlock log was cut in the Wynoochee River drainage.

stocked unmanaged stands (McArdle 1961), and on hemlock site 150 land, 11,300 cubic feet can be grown in 70 years in fully stocked unmanaged stands (Barnes 1962).

430,000 Acres Now Stocked With Hardwoods Have Grown Conifer Timber in the Past

In the Olympic Peninsula there are 539,000 acres of hardwood type, primarily in private ownership, of which 467,000 acres or 87 percent is red alder. Of the total hardwood-type area, 430,000 acres or 80 percent has grown conifer timber in the past, but after logging or burning has restocked with alder (fig. 8). Many alder stands now have an understory component of conifer trees that will slowly take over the site as the short-lived alder dies out.

Present Cubic-Foot Yield in Hardwood Stands Is About Three-Fourths Conifer Potential; Future Production Loss Could Be Greater

Most of the merchantable hardwood stands on the Olympic Peninsula are in the 30- and 40-year age classes. At this stage in stand development, red alder produces about as much cubic-foot volume per acre as Douglas-fir according to the red alder and Douglas-fir yield tables. Present yield in hardwood is 78 percent of the Douglas-fir yield table values.[3] As these hardwood stands grow older, the loss in fiber production will increase, since Douglas-

[3] *Douglas-fir site trees were present in many red alder stands; where Douglas-fir site trees were not available, we assumed that alder site 90 equals Douglas-fir site 140 on lands where Douglas-fir has grown in the past.*

Figure 8. — Hardwoods such as this red alder stand occupy 430,000 acres that have grown conifer timber in the past.

fir stands produce more volume in the fourth and fifth decades than red alder stands. Also, with the current low market value of alder compared with that of Douglas-fir, the loss in income will be greater than the loss in fiber production.

In general, forest managers are converting hardwood types to conifers on sites where conifers have grown before. Where present hardwoods show promise of developing into merchantable stands, foresters usually wait for a harvest cut before converting to conifers. In the next decade or two, as present hardwoods grow, the hardwood volume will probably increase; but then as mature stands are cut and the land regenerated to conifers, the hardwood volume will decrease.

Production of hardwoods on the 109,000 acres of land not suited to conifers is only 65 percent of alder yield table value. On some of these sites, red alder is a minor component and other species such as Oregon ash, black cottonwood, bigleaf maple, and willow predominate. There is little likelihood that timber production will be increased on these hardwood sites. Maximum potential yields are low compared with conifer yields. The market value of these hardwoods is relatively low (currently less than half the dollar value per unit of Douglas-fir), and the canyon bottoms, streambanks, and valleys where these hardwoods grow are often the same lands demanded by recreationists, developers, roadbuilders, and farmers.

Western red cedar - a declining resource

Western redcedar has been the basis of an important timber industry on the Olympic Peninsula for many decades and still contributes to the local economy and the Nation's homebuilding industry. In 1963, there were over 70 shake and shingle mills in the Olympic Peninsula counties producing a total of over $10 million worth of taper split and resawn cedar shakes, or about 39 percent of the total cedar shake production in Oregon and Washington.[4] Since 1963, at least two large cedar mills have been built on the Peninsula. Shake production figures for the industry as a whole show an increase of about 400 percent from 1957 to 1964 and an increase of over 90 percent from 1964 to 1967.

The Olympic Peninsula has 8,339 million board feet (International 1/4-inch scale) of western redcedar, one-fourth of all the redcedar in Oregon and Washington. There is another 700 million board feet of usable volume in dead trees. In addition to the volume in live and salvable dead trees, there is an unknown but evidently substantial volume of redcedar wood in logs and chunks of trees not counted in the current inventory. These pieces are currently being salvaged by cedar splitters who, working with chain saw and the traditional mallet and froe, can use material of any size or shape, so long as it will yield a 24-inch long "shake board" or "blank" (Douglass 1965) (salvage volume makes up about 17 percent of the Olympic cedar shake output).

Nearly 90 percent of the live redcedar volume is old growth, and about 55 percent is in trees 39 inches and larger. About 5,200 million board feet of the old-growth redcedar is concentrated along the Pacific Ocean in western Clallam, Jefferson, and Grays Harbor Counties with particularly heavy concentration in northwestern Grays Harbor County.

In 1967, 347 million board feet (International 1/4-inch scale) of live western redcedar were cut on the Olympic Peninsula. This is over half of the total redcedar cut in the State of Washington (State of Washington Department of Natural Resources [n.d.]). Current net annual growth of redcedar on the Olympic Peninsula is 66.3 million board feet. Less than half of this growth is in the coastal belt where the cedar volume and cedar industries are concentrated. Redcedar growth can probably be discounted anyway, because young-growth cedar is usually unsuitable for products now being made from cedar wood. Young-growth cedar contains a high percentage of sapwood, is relatively knotty, and often tends to be riddled with wormholes. Cedar is also slow growing, and timberland managers are not likely to hold stands long enough for trees to reach merchantable size and quality. For these reasons, no attempt is being made to regenerate cedar after logging (fig. 9). Once the current volume of old-growth cedar is harvested, the cedar shake and shingle industry on the Olympic Peninsula will be drastically reduced.

At the present rate of cutting, the live and salvable dead cedar could last about 25 years, but the concentrated reserves will probably be depleted much sooner, followed by a rapid decline in the cedar industry on the Peninsula.

[4] *Teshera, James M. A survey of the handsplit shake industry of the Northwest. 1963. (Report of a survey conducted for the Handsplit Cedar Shake Association, Seattle.)*

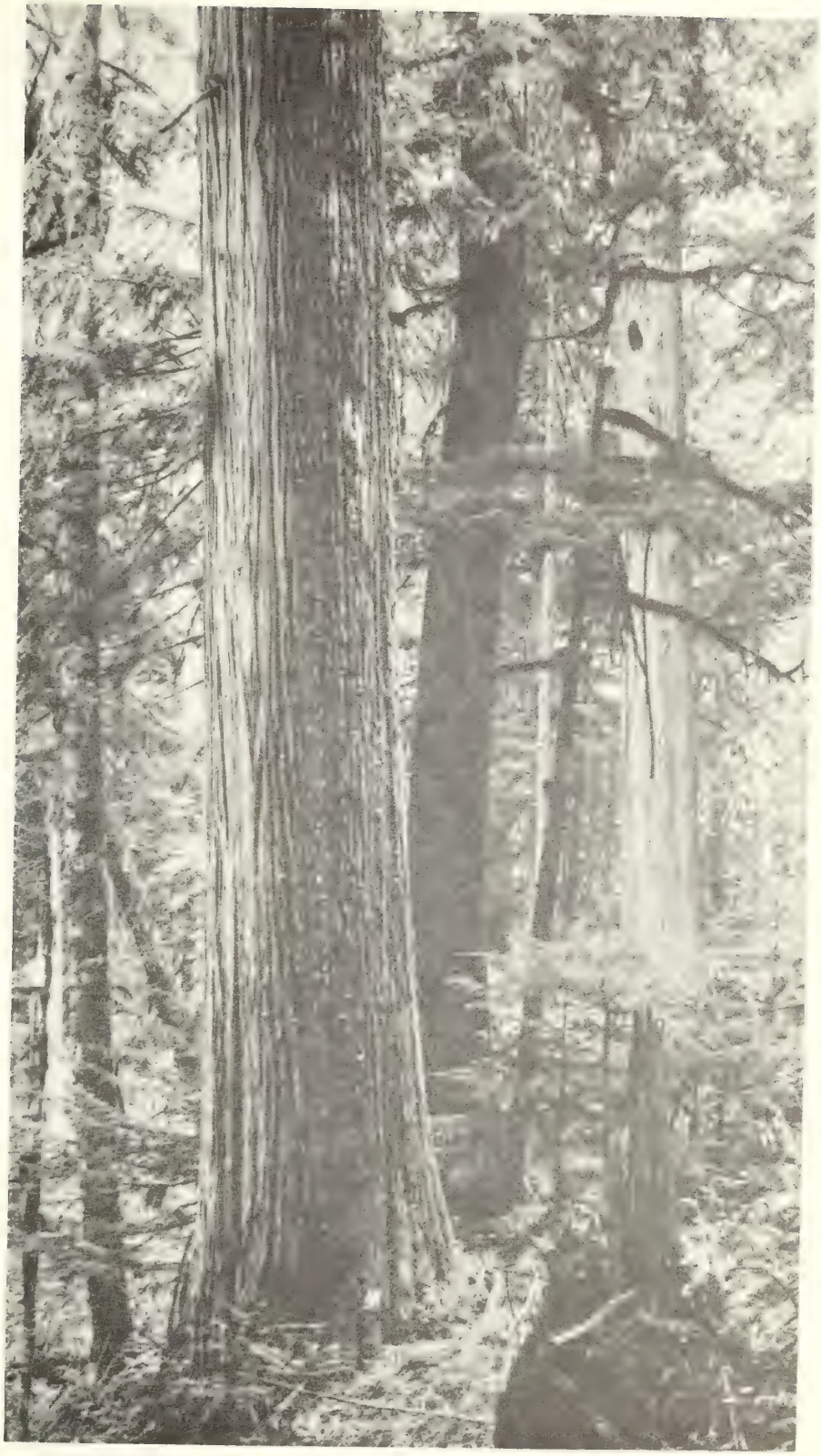

Figure 9. — Old-growth western redcedar timber is required for the products currently made from redcedar. Western redcedar stands such as this, typical of the coastal cedar belt, cannot be grown on a continuous yield basis. Hemlock or Douglas-fir will replace them in the future.

Future competition for forest land

The past few years have brought a tremendous increase in population and industrialization to the Puget Sound area which lies to the immediate east of the Olympic Peninsula. It is predicted that by 1990 there will be 2.7 million people in King, Kitsap, Pierce, and Snohomish Counties alone (Little 1964), a number nearly equal to Washington's entire 1960 population. The demand for outdoor recreation is increasing at four times the rate of population increase; the standard of living is rising; shorter workweeks are predicted. Already the Olympic Peninsula is feeling pressure from the Puget Sound area, as more and more people go to the woods and mountains to camp, hike, fish, and hunt, and to live.

A considerable area of forest land in the Olympic Peninsula outside the National Forest and National Park has already been taken out of timber production for permanent and summer homesites, commercial developments, and recreational use. Development has not been extensive in the western part of the Peninsula, being generally confined to a strip along the immediate coast and a few tracts near streams and lakes. In much of the eastern part of the Peninsula, however, development has been extensive and in the future may end timber production on a large area of forest land (fig. 10).

It is difficult to forecast how far and at what rate this development will spread. Various planning groups such as the Puget Sound Governmental Conference, county planning commissions, and the Washington State Department of Natural Resources have been studying the problems of urbanization and land use. Based on these studies and other information, it is estimated that by the year 2000 an urban-suburban area will have spread well into Mason and Thurston Counties (fig. 11).

There are other areas on the Peninsula where development may take forest lands out of timber production. These include the coastal area near Grays Harbor, the Port Angeles-Port Townsend area, and a strip along the west bank of Hood Canal.

At the present time, the projected urban-suburban area in Mason and Thurston Counties alone contains 235,000 acres of commercial forest land, representing 7.6 percent of the Olympic Peninsula's total. About 42 percent of this is owned by forest industries; 37 percent by farmer and miscellaneous private owners; and 21 percent by other public owners. Growing-stock volume in this area totals 539 million cubic feet with 403 million in softwoods and 136 million in hardwoods. Sawtimber volume is 1,900 million board feet (International 1/4-inch scale).

How much of this 1,900 million board feet will be harvested is impossible to say. Local timber operators are finding that some of the owners of small forest properties who have merchantable stands of timber are changing their minds about selling stumpage, figuring their lands will be worth more as real estate if they leave the large trees standing. On the other hand, in spite of rising land values and increasing land use competition, some timber companies are increasing and upgrading their timberland holdings. Most of these companies will probably sell some of their lands for real estate in the future or go into other lines of land development themselves. Some timber companies already have real estate divisions.

Much of this prospective urban-suburban area is of relatively low site quality, characterized by extensive glacial gravel flats with Douglas-fir site indexes of 120 and lower predominating. As urban developments move westward, however, they will encroach steadily upon the higher site forest land. Once out

Figure 10. — Real estate and recreational developments in the eastern part of the Olympic Peninsula are taking an increasing area of commercial forest land out of timber production.

of the glaciated country near the present urban area, they will take over the valleys and streambottoms first, and these are often the most productive lands.

The future of this "fringe forest" area is uncertain. Past and present trends indicate that timber production will become less and less important and possibly disappear entirely. The State of Washington plans not to invest money for long-range forest management purposes on much of their forest land within this area, and it has been predicted that the majority of small private ownerships in the fringe forest area of Puget Sound will go out of forestry use by 1985 (Parker 1966). These two ownerships control about a third of the commercial forest land in the prospective urban land use area. A substantial portion of this area is owned by investors, speculators, and developers who are steadily converting it to nontimber-growing uses. Though it appears this entire area will eventually be developed for nonforestry purposes, there is a possibility that strips and blocks will be kept in forest reserves as part of a broad plan for open space preservation. Under such a plan, management of some stands for timber production would still be possible.

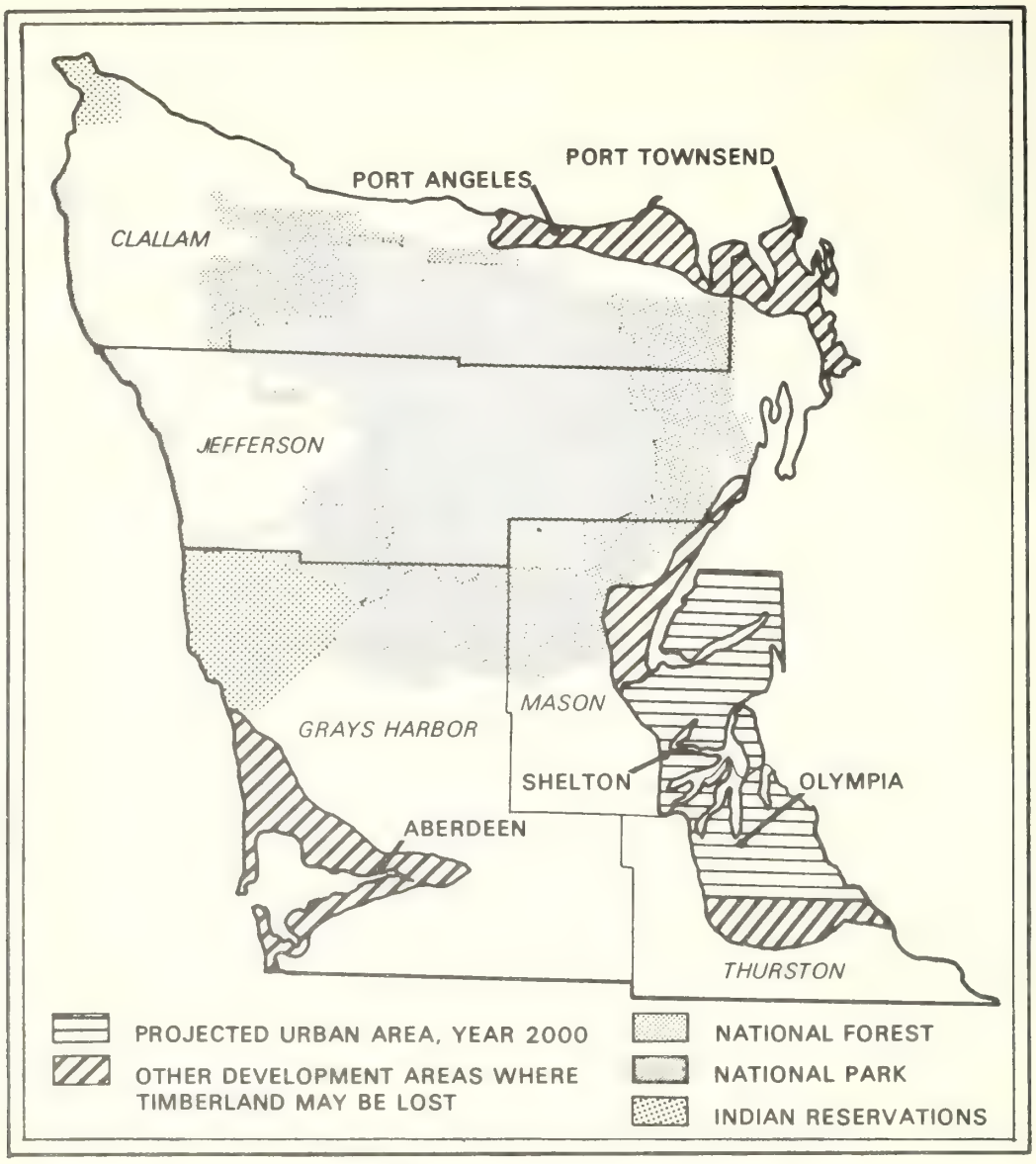

Figure 11. — Map of Olympic Peninsula showing projected urban area, year 2000, and other development areas where timberland may be lost.

For the future, it appears that much of this 235,000 acres and the timber on it will eventually be removed from the raw material base for the forest products industries. In addition, there will undoubtedly be forest land losses in other development areas on the Peninsula with concomitant losses of timber volume and annual growth. If softwood timber production is to remain the same or be increased, more intensive management of remaining lands will be necessary. Such activities might include increased commercial and precommercial thinning, planting of superior genetic stock, more complete utilization of trees and stands, salvage of more of the annual mortality, conversion of hardwood stands to conifers, and possibly fertilization. Without intensification of management, the loss of forest land on the Peninsula would eventually lead to a reduction in the timber industry.

Table 3. — Area by land class and county, Olympic Peninsula, Washington, January 1, 1966
(In thousand acres)

Land class	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Forest land:						
Commercial	3,105	698	1,099	542	474	292
Productive reserved[1]	553	168	10	318	56	1
Unproductive	372	119	21	184	33	15
Total	4,030	985	1,130	1,044	563	308
Nonforest land[2]	547	137	88	115	56	151
Total area[3]	4,577	1,122	1,218	1,159	619	459

[1] *Includes 35,000 acres of land managed for Christmas tree production.*

[2] *Includes cropland, pasture and range, swampland, industrial and urban areas, powerline clearings, railroads and all improved roads and highways, and 20,000 acres classed as water by Forest Survey standards, but defined by the Bureau of the Census as land.*

[3] *Source: United States Bureau of the Census, Land and Water Area of the United States, 1960.*

Table 4. — Area of commercial forest land by ownership class and county, Olympic Peninsula, Washington, January 1, 1966
(In thousand acres)

Ownership class	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Public:						
National Forest	539	180	131	123	105	([1])
Other Federal						
Indian	165	26	133	2	3	1
Miscellaneous Federal	21	1	--	--	3	17
Total other Federal	186	27	133	2	6	18
State	549	160	83	192	56	58
County and municipal	68	--	52	13	3	--
Total public	1,342	367	399	330	170	76
Private:						
Forest industry	1,139	218	488	115	224	94
Farmer-owned	63	14	24	8	--	17
Miscellaneous private	561	99	188	89	80	105
Total private	1,763	331	700	212	304	216
All ownerships	3,105	698	1,099	542	474	292

[1] *Less than 500 acres of Snoqualmie National Forest.*

Table 5. — Area of commercial forest land by stand-size and ownership classes, Olympic Peninsula, Washington, January 1, 1966

(In thousand acres)

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Sawtimber stands:					
Old growth[1]	644	243	254	108	39
Young growth[2]	1,284	132	261	568	323
Total	1,928	375	515	676	362
Poletimber stands	543	58	146	209	130
Sapling and seedling stands	589	86	139	246	118
Nonstocked areas	45	20	3	8	14
All classes	3,105	539	803	1,139	624

[1] *Stands 140 years and older.*

[2] *Stands less than 140 years old.*

Table 6. — Area of commercial forest land by stand volume and by ownership class, Olympic Peninsula, Washington, January 1, 1966

(In thousand acres)

Stand volume (board feet per acre[1])	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Less than 1,500	692	119	162	255	156
1,500 to 4,999	404	32	91	178	103
5,000 to 9,999	353	30	97	107	119
10,000 to 19,999	429	41	99	181	108
20,000 to 29,999	229	36	37	112	44
30,000 to 39,999	249	45	42	120	42
40,000 to 49,999	158	43	41	53	21
50,000 or more	591	193	234	133	31
All classes	3,105	539	803	1,139	624

[1] *Net volume, International 1/4-inch scale.*

Table 7. — Area of commercial forest land by cubic-foot site and ownership classes, Olympic Peninsula, Washington, January 1, 1966

(In thousand acres)

Site class[1] (cubic feet per acre)	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
225 or more	370	41	98	181	50
165 to 224	793	128	235	333	97
120 to 164	916	152	240	345	179
85 to 119	540	106	143	147	144
50 to 84	453	100	78	126	149
20 to 49	33	12	9	7	5
Less than 20	--	--	--	--	--
All classes	3,105	539	803	1,139	624

[1] *A classification in terms of capacity for cubic-foot annual growth per acre at culmination of mean annual growth.*

Table 8. — Area of commercial forest land by forest type and ownership class, Olympic Peninsula, Washington, January 1, 1966

(In thousand acres)

Forest type	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Douglas-fir	913	187	203	332	191
Western hemlock	1,211	233	349	455	174
Mountain hemlock	3	3	--	--	--
Western redcedar	231	32	83	50	66
Alaska cedar	2	2	--	--	--
Pacific silver fir	77	52	25	--	--
Grand fir	1	1	--	--	--
Sitka spruce	45	2	9	31	3
Lodgepole pine	38	1	17	20	--
Red alder	467	4	105	208	150
Bigleaf maple	13	1	--	6	6
Other commercial hardwoods	15	1	--	14	--
Noncommercial hardwoods	44	--	9	15	20
Nonstocked	45	20	3	8	14
All types	3,105	539	803	1,139	624

Table 9. — Area of noncommercial forest land by forest type, Olympic Peninsula, Washington, January 1, 1966

(In thousand acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
Douglas-fir	203	203[1]	--
Western hemlock	237	237	--
Western redcedar	([2])	([2])	--
Pacific silver fir	107	107	--
Sitka spruce	([2])	([2])	--
Lodgepole pine	1	1	--
Red alder	5	5	--
Noncommercial rocky	122	--	122
Noncommercial subalpine	223	--	223
Noncommercial other	27	--	27
All types	925	553	372

[1] *Includes 35,000 acres of land managed for Christmas tree production.*

[2] *Less than 500 acres.*

Table 10. — Volume of growing stock and sawtimber on commercial forest land by ownership class and by softwoods and hardwoods, Olympic Peninsula, Washington, January 1, 1966

Ownership class	Average volume per acre	Total volume		
		All species	Softwoods	Hardwoods
	Cubic feet	*Million cubic feet*		
All growing stock:				
National Forest	7,152	3,855	3,825	30
Other public	5,837	4,687	4,412	275
Forest industry	4,114	4,686	4,119	567
Farmer and miscellaneous private	3,247	2,026	1,608	418
All ownerships	4,913	15,254	13,964	1,290
	Board feet	*Million board feet*		
Sawtimber (International 1/4-inch scale):				
National Forest	47,143	25,410	25,302	108
Other public	30,768	24,707	24,016	691
Forest industry	19,801	22,553	21,162	1,391
Farmer and miscellaneous private	14,093	8,794	7,401	1,393
All ownerships	26,236	81,464	77,881	3,583
Sawtimber (Scribner scale):				
National Forest	39,662	21,378	21,270	108
Other public	23,428	18,813	18,143	670
Forest industry	14,801	16,858	15,509	1,349
Farmer and miscellaneous private	10,715	6,686	5,334	1,352
All ownerships	20,527	63,735	60,256	3,479

Table 11. — Volume of growing stock and sawtimber on commercial forest land by county and ownership class, Olympic Peninsula, Washington, January 1, 1966

County	Average volume per acre	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
	Cubic feet	*Million cubic feet*				
Growing stock:						
Clallam	5,511	3,847	1,101	1,136	1,105	505
Grays Harbor	4,353	4,784	1,020	1,090	1,957	717
Jefferson	7,212	3,909	896	2,128	598	287
Mason	4,169	1,976	835	167	709	265
Thurston	2,527	738	3	166	317	252
All counties	4,913	15,254	3,855	4,687	4,686	2,026
	Board feet	*Million board feet*				
Sawtimber (International 1/4-inch scale):						
Clallam	30,403	21,221	7,022	5,767	5,854	2,578
Grays Harbor	22,019	24,199	7,132	5,152	8,587	3,328
Jefferson	42,308	22,931	5,852	12,653	3,377	1,049
Mason	21,515	10,198	5,385	525	3,251	1,037
Thurston	9,983	2,915	19	610	1,484	802
All counties	26,236	81,464	25,410	24,707	22,553	8,794
Sawtimber [illegible]						
Clallam	23,582	16,460	5,666	4,367	4,445	1,982
Grays Harbor	17,008	18,692	6,162	3,710	6,292	2,528
Jefferson	33,557	18,188	4,880	9,900	2,600	808
Mason	17,234	8,169	4,652	359	2,378	780
Thurston	7,623	2,226	18	477	1,143	588
All counties	20,527	63,735	21,378	18,813	16,858	6,686

Table 12. — Number of growing-stock trees on commercial forest land by diameter class and by softwoods and hardwoods, Olympic Peninsula, Washington, January 1, 1966
(Thousands of trees)

Diameter class (inches b.h.)	All species	Softwoods	Hardwoods
5.0 - 6.9	144,737	111,430	33,307
7.0 - 8.9	107,023	77,032	29,991
9.0 - 10.9	68,654	51,754	16,900
11.0 - 12.9	45,269	36,229	9,040
13.0 - 14.9	29,794	24,517	5,277
15.0 - 16.9	20,356	17,414	2,942
17.0 - 18.9	14,000	12,708	1,292
19.0 - 20.9	9,969	9,559	410
21.0 - 28.9	21,278	20,516	762
29.0 - 38.9	9,761	9,677	84
39.0 and larger	5,373	5,352	21
All classes	476,214	376,188	100,026

Table 13. — Average number of growing-stock trees per acre on commercial forest land by diameter and ownership classes, Olympic Peninsula, Washington, January 1, 1966

Diameter class (inches b.h.)	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
5.0 - 6.9	46.6	38.2	48.6	46.4	51.9
7.0 - 8.9	34.5	24.1	35.7	37.5	36.3
9.0 - 10.9	22.1	16.2	24.4	22.9	22.8
11.0 - 12.9	14.6	10.1	16.0	15.1	15.7
13.0 - 14.9	9.6	7.6	10.7	9.9	9.3
15.0 - 16.9	6.6	5.9	7.2	6.8	5.7
17.0 - 18.9	4.5	5.3	4.5	4.5	4.0
19.0 - 20.9	3.2	4.3	3.7	2.7	2.5
21.0 - 28.9	6.9	11.6	7.2	5.8	4.3
29.0 - 38.9	3.1	7.0	3.6	2.1	1.0
39.0 and larger	1.7	4.2	2.3	.8	.5
All classes	153.4	134.5	163.9	154.5	154.0

Table 14. — Number of growing-stock trees on commercial forest land by species and diameter class, Olympic Peninsula, Washington, January 1, 1966
(Thousand trees)

Species	Diameter class (inches at breast height)											
	All classes	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:												
Douglas-fir	120,665	34,775	28,054	17,759	11,621	7,729	5,367	4,307	2,704	5,606	1,800	943
Western hemlock	188,026	57,192	37,998	25,680	18,242	12,765	8,903	6,045	4,586	10,060	4,686	1,869
Mountain hemlock	417	69	42	30	38	20	42	25	28	86	31	6
Western redcedar	34,177	10,093	6,862	3,563	2,849	1,762	1,470	1,260	1,139	2,533	1,266	1,380
Alaska cedar	558	132	107	93	50	20	24	25	10	38	40	19
Pacific silver fir	18,546	4,267	2,437	1,869	2,052	1,262	999	698	800	1,731	1,550	881
Grand fir	774	172	37	160	146	8	12	113	26	70	23	7
Subalpine fir	52	--	13	13	8	11	--	3	--	4	--	--
Sitka spruce	7,308	2,794	993	1,141	730	213	351	144	154	312	241	235
Lodgepole pine	5,400	1,936	435	1,392	493	706	215	88	89	46	--	--
Western white pine	265	--	54	54	--	21	31	--	23	30	40	12
Total	376,188	111,430	77,032	51,754	36,229	24,517	17,414	12,708	9,559	20,516	9,677	5,352
Hardwoods:												
Red alder	84,348	27,486	26,311	13,959	7,919	4,564	2,381	892	252	545	39	--
Bigleaf maple	9,484	2,222	2,306	2,319	967	535	418	295	155	204	45	18
Black cottonwood	193	--	--	--	60	--	90	24	3	13	--	3
Pacific madrone	2,642	2,057	271	266	--	--	--	48	--	--	--	--
Other hardwoods[1]	3,359	1,542	1,103	356	94	178	53	33	--	--	--	--
Total	100,026	33,307	29,991	16,900	9,040	5,277	2,942	1,292	410	762	84	21
All species	476,214	144,737	107,023	68,654	45,269	29,794	20,356	14,000	9,969	21,278	9,761	5,373

[1] *Primarily Oregon ash and Oregon white oak.*

Table 15. — Volume of timber on commercial forest land by class of timber and by softwoods and hardwoods, Olympic Peninsula, Washington, January 1, 1966
(In million cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Saw-log portion	12,342	11,809	533
Upper-stem portion	530	391	139
Total	12,872	12,200	672
Poletimber trees	2,382	1,764	618
All growing-stock trees	15,254	13,964	1,290
Sound cull trees	253	167	86
Rotten cull trees	261	253	8
Salvable dead sawtimber trees	579	570	9
Total, all timber	16,347	14,954	1,393

Table 16. — Volume of growing stock and sawtimber on commercial forest land by stand-size class and by softwoods and hardwoods, Olympic Peninsula, Washington, January 1, 1966

Stand-size class	Average volume per acre	All species	Softwoods	Hardwoods
	Cubic feet	*Million cubic feet*		
All growing stock:				
Sawtimber stands	7,132	13,750	12,829	921
Poletimber stands	2,320	1,260	924	336
Sapling and seedling stands and nonstocked areas	385	244	211	33
All stands	4,913	15,254	13,964	1,290
	Board feet	*Million board feet*		
Sawtimber (International 1/4-inch scale):				
Sawtimber stands	40,706	78,482	75,224	3,258
Poletimber stands	4,006	2,175	1,935	240
Sapling and seedling stands and nonstocked areas	1,273	807	722	85
All stands	26,236	81,464	77,881	3,583
Sawtimber (Scribner scale):				
Sawtimber stands	31,963	61,625	58,466	3,159
Poletimber stands	2,779	1,509	1,273	236
Sapling and seedling stands and nonstocked areas	948	601	517	84
All stands	20,527	63,735	60,256	3,479

Table 17. — Volume of growing stock on commercial forest land by species and county, Olympic Peninsula, Washington, January 1, 1966
(In million cubic feet)

Species	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Softwoods:						
Douglas-fir	3,555	679	770	506	1,165	435
Western hemlock	6,895	2,070	2,452	1,970	391	12
Mountain hemlock	22	--	11	1	10	--
Western redcedar	1,462	382	528	395	121	36
Alaska cedar	23	2	7	1	13	--
Pacific silver fir	1,486	316	294	823	53	--
Grand fir	34	9	1	2	19	3
Subalpine fir	1	--	--	1	([1])	--
Sitka spruce	379	164	159	51	5	--
Lodgepole pine	79	([1])	73	--	6	--
Western white pine	28	2	22	1	3	--
Total	13,964	3,624	4,317	3,751	1,786	486
Hardwoods:						
Red alder	1,095	189	428	142	142	194
Bigleaf maple	147	31	37	9	43	27
Black cottonwood	9	1	2	--	--	6
Pacific madrone	16	2	--	7	5	2
Other hardwoods[2]	23	--	--	--	--	23
Total	1,290	223	467	158	190	252
All species	15,254	3,847	4,784	3,909	1,976	738

[1] *Less than 500,000 cubic feet.*

[2] *Primarily Oregon ash and Oregon white oak.*

Table 18. — Volume of sawtimber on commercial forest land by species and county, Olympic Peninsula, Washington, January 1, 1966 (International 1/4-inch scale)
(In million board feet)

Species	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Softwoods:						
Douglas-fir	18,491	3,736	4,254	2,636	5,885	1,980
Western hemlock	38,026	11,356	12,445	11,850	2,305	70
Mountain hemlock	142	--	77	7	58	--
Western redcedar	8,339	2,272	2,869	2,367	692	139
Alaska cedar	149	12	50	3	84	--
Pacific silver fir	9,697	2,024	2,003	5,345	325	--
Grand fir	183	33	7	13	115	15
Subalpine fir	7	--	--	4	3	--
Sitka spruce	2,403	1,118	932	331	22	--
Lodgepole pine	272	--	272	--	--	--
Western white pine	172	10	136	9	17	--
Total	77,881	20,561	23,045	22,565	9,506	2,204
Hardwoods:						
Red alder	2,912	491	1,067	342	487	525
Bigleaf maple	562	161	77	22	191	111
Black cottonwood	51	8	10	2	--	31
Pacific madrone	14	--	--	--	14	--
Other hardwoods[1]	44	--	--	--	--	44
Total	3,583	660	1,154	366	692	711
All species	81,464	21,221	24,199	22,931	10,198	2,915

[1] *Primarily Oregon ash and Oregon white oak.*

Table 19. — Volume of growing stock on commercial forest land by species and ownership class, Olympic Peninsula, Washington, January 1, 1966
(In million cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	3,555	1,212	581	1,165	597
Western hemlock	6,895	1,570	2,322	2,319	684
Mountain hemlock	22	22	--	--	--
Western redcedar	1,462	277	604	334	247
Alaska cedar	23	23	--	--	--
Pacific silver fir	1,486	656	698	122	10
Grand fir	34	9	6	3	16
Subalpine fir	1	1	--	--	--
Sitka spruce	379	43	142	142	52
Lodgepole pine	79	7	37	33	2
Western white pine	28	5	22	1	–
Total softwoods	13,964	3,825	4,412	4,119	1,608
Hardwoods:					
Red alder	1,095	20	260	477	338
Bigleaf maple	147	8	12	71	56
Black cottonwood	9	1	2	6	--
Pacific madrone	16	1	1	--	14
Other hardwoods[1]	23	([2])	--	13	10
Total hardwoods	1,290	30	275	567	418
All species	15,254	3,855	4,687	4,686	2,026

[1] *Primarily Oregon ash and Oregon white oak.*

[2] *Less than 500,000 cubic feet.*

Table 20. — Volume of sawtimber on commercial forest land by species and ownership class, Olympic Peninsula, Washington, January 1, 1966 (International 1/4-inch scale)
(In million board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	18,491	7,818	2,488	5,779	2,406
Western hemlock	38,026	10,384	12,438	11,988	3,216
Mountain hemlock	142	142	--	--	--
Western redcedar	8,339	1,961	3,360	1,683	1,335
Alaska cedar	149	149	--	--	--
Pacific silver fir	9,697	4,448	4,410	777	62
Grand fir	183	56	31	15	81
Subalpine fir	7	7	--	--	--
Sitka spruce	2,403	279	1,004	829	291
Lodgepole pine	272	29	150	83	10
Western white pine	172	29	135	8	--
Total softwoods	77,881	25,302	24,016	21,162	7,401
Hardwoods:					
Red alder	2,912	61	606	1,120	1,125
Bigleaf maple	562	38	70	215	239
Black cottonwood	51	9	11	31	--
Pacific madrone	14	--	4	--	10
Other hardwoods[1]	44	--	--	25	19
Total hardwoods	3,583	108	691	1,391	1,393
All species	81,464	25,410	24,707	22,553	8,794

[1] *Primarily Oregon ash and Oregon white oak.*

Table 21. — Volume of growing stock on commercial forest land by species and diameter class, Olympic Peninsula, Washington, January 1, 1966
(In million cubic feet)

Species	Diameter class (inches at breast height)											
	All classes	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0 16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:												
Douglas-fir	3,555	131	215	246	257	251	247	261	212	684	442	609
Western hemlock	6,895	228	316	396	451	466	455	419	399	1,428	1,322	1,015
Mountain hemlock	22	([1])	([1])	1	1	1	2	1	2	8	4	2
Western redcedar	1,462	30	40	37	45	40	48	54	61	219	218	670
Alaska cedar	23	([1])	([1])	1	1	1	1	1	([1])	4	7	7
Pacific silver fir	1,486	15	17	27	45	44	48	46	67	238	439	500
Grand fir	34	1	([1])	3	3	([1])	1	7	2	9	5	3
Subalpine fir	1	--	([1])	([1])	([1])	1	--	([1])	--	([1])	--	--
Sitka spruce	379	10	8	14	15	6	15	9	12	36	63	191
Lodgepole pine	79	6	4	18	11	20	8	5	5	2	--	--
Western white pine	28	--	([1])	([1])	--	1	1	--	2	5	11	8
Total softwoods	13,964	421	600	743	829	831	826	803	762	2,633	2,511	3,005
Hardwoods:												
Red alder	1,095	109	223	206	181	151	105	48	17	49	6	--
Bigleaf maple	147	9	17	26	16	14	15	13	9	14	9	5
Black cottonwood	9	([1])	([1])	--	2	--	3	1	--	2	--	1
Pacific madrone	16	8	2	4	--	--	--	2	--	--	--	--
Other hardwoods[2]	23	4	6	4	2	4	1	2	--	--	--	--
Total hardwoods	1,290	130	248	240	201	169	124	66	26	65	15	6
All species	15,254	551	848	983	1,030	1,000	950	869	788	2,698	2,526	3,011

[1] *Less than 500,000 cubic feet.*

[2] *Primarily Oregon ash and Oregon white oak.*

Table 22. — Volume of sawtimber on commercial forest land by species and diameter class, Olympic Peninsula, Washington, January 1, 1966 (International 1/4-inch scale)
(In million board feet)

Species	Diameter class (inches at breast height)								
	All classes	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:									
Douglas-fir	18,491	1,266	1,314	1,361	1,498	1,267	4,289	3,019	4,477
Western hemlock	38,026	2,168	2,471	2,597	2,532	2,494	9,513	9,231	7,020
Mountain hemlock	142	5	3	8	6	12	50	37	21
Western redcedar	8,339	212	197	243	281	333	1,188	1,287	4,598
Alaska cedar	149	3	2	5	7	([1])	28	50	54
Pacific silver fir	9,697	244	245	284	279	407	1,560	3,045	3,633
Grand fir	183	20	1	3	35	12	54	32	26
Subalpine fir	7	1	2	--	1	--	3	--	--
Sitka spruce	2,403	86	37	93	51	73	231	401	1,431
Lodgepole pine	272	55	107	43	22	28	17	--	--
Western white pine	172	--	5	8	--	12	30	65	52
Total softwoods	77,881	4,060	4,384	4,645	4,712	4,638	16,963	17,167	21,312
Hardwoods:									
Red alder	2,912	860	767	556	273	100	313	43	--
Bigleaf maple	562	72	74	79	68	48	94	73	54
Black cottonwood	51	6	--	19	8	11	--	--	7
Pacific madrone	14	--	--	--	14	--	--	--	--
Other hardwoods[2]	44	8	20	6	10	--	--	--	--
Total hardwoods	3,583	946	861	660	373	159	407	116	61
All species	81,464	5,006	5,245	5,305	5,085	4,797	17,370	17,283	21,373

[1] *Less than 500,000 board feet.*

[2] *Primarily Oregon ash and Oregon white oak.*

Table 23. — Volume of sawtimber on commercial forest land by species and diameter class, Olympic Peninsula, Washington, January 1, 1966 (Scribner scale)
(In million board feet)

Species	Diameter class (inches at breast height)								
	All classes	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:									
Douglas-fir	14,134	711	800	884	1,017	897	3,283	2,493	4,049
Western hemlock	29,341	1,266	1,558	1,736	1,761	1,809	7,307	7,625	6,279
Mountain hemlock	112	3	2	5	4	7	41	31	19
Western redcedar	6,377	116	113	147	174	203	815	945	3,864
Alaska cedar	109	2	1	2	5	2	18	38	41
Pacific silver fir	7,828	136	150	185	190	292	1,217	2,541	3,117
Grand fir	138	10	1	2	24	9	42	26	24
Subalpine fir	5	1	1	--	1	--	2	--	--
Sitka spruce	1,916	42	21	55	34	50	168	326	1,220
Lodgepole pine	158	31	61	26	12	17	11	--	--
Western white pine	138	--	3	5	--	9	25	54	42
Total softwoods	60,256	2,318	2,711	3,047	3,222	3,295	12,929	14,079	18,655
Hardwoods:									
Red alder	2,818	822	739	539	267	101	307	43	--
Bigleaf maple	554	69	72	77	66	45	95	75	55
Black cottonwood	50	5	--	18	8	1	10	--	8
Pacific madrone	14	--	--	--	14	--	--	--	--
Other hardwoods[1]	43	7	20	6	10	--	--	--	--
Total hardwoods	3,479	903	831	640	365	147	412	118	63
All species	63,735	3,221	3,542	3,687	3,587	3,442	13,341	14,197	18,718

[1] *Primarily Oregon ash and Oregon white oak.*

Table 24 — Area of commercial forest land and volume of growing stock and sawtimber by stand age and ownership classes, Olympic Peninsula, Washington, January 1, 1966

Stand age (years)	All ownerships			National Forest			Other public			Forest industry			Farmer and miscellaneous private		
	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber
		Million cubic feet	*Million board feet*[1]		*Million cubic feet*	*Million board feet*[1]		*Million cubic feet*	*Million board feet*[1]		*Million cubic feet*	*Million board feet*[1]		*Million cubic feet*	*Million board feet*[1]
Nonstocked:[2]	45	--	--	20	--	--	3	--	--	8	--	--	14	--	--
0 - 9	362	125	517	35	2	--	90	29	137	156	59	292	81	35	88
10 - 19	232	182	341	32	5	17	49	43	121	109	101	105	42	33	98
20 - 29	397	828	2,060	23	30	116	98	190	344	181	408	1,134	95	200	466
30 - 39	416	1,492	4,966	3	4	11	154	589	1,896	164	591	1,994	95	308	1,065
40 - 49	321	1,476	5,893	38	94	257	66	412	1,734	137	658	2,687	80	312	1,215
50 - 59	117	656	3,076	2	4	11	10	61	311	61	377	1,820	44	214	934
60 - 69	85	448	2,192	20	81	286	7	70	391	31	190	1,050	27	107	465
70 - 79	26	149	777	5	18	80	18	92	454	--	--	--	3	39	243
80 - 89	17	91	411	9	45	200	5	25	88	3	21	123	--	--	--
90 - 99	7	60	357	2	15	95	3	29	177	2	16	85	--	--	--
100 - 109	22	199	1,229	10	68	397	--	--	--	12	131	832	--	--	--
110 - 119	6	47	252	2	17	115	4	30	137	--	--	--	--	--	--
120 - 129	10	78	478	7	41	251	--	--	--	3	37	227	--	--	--
130 - 159	21	210	1,277	17	154	908	--	--	--	4	56	369	--	--	--
160 - 199	24	264	1,620	20	215	1,313	--	--	--	4	49	307	--	--	--
Over 200	389	4,255	28,125	210	2,368	16,709	122	1,272	7,631	42	408	2,467	15	207	1,318
Uneven, under rotation age[2]	333	1,697	8,929	34	63	464	42	313	1,726	153	962	5,192	104	359	1,547
Uneven, over rotation age[2]	275	2,997	18,964	50	631	4,180	132	1,532	9,560	69	622	3,869	24	212	1,355
Total, all classes	3,105	15,254	81,464	539	3,855	25,410	803	4,687	24,707	1,139	4,686	22,553	624	2,026	8,794

[1] *International 1/4-inch scale*

[2] *See "Definition of Terms," page 55.*

Table 25. — Net annual growth of growing stock on commercial forest land by species and ownership class, Olympic Peninsula, Washington, 1965
(In thousand cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	127,890	3,700	31,660	57,400	35,130
Western hemlock	115,100	3,200	33,850	52,180	25,870
Western redcedar	14,730	1,200	3,990	4,750	4,790
Sitka spruce	9,510	800	2,260	4,690	1,760
True firs	820	-400[1]	-1,560[1]	2,000	780
Other conifers	-670[1]	-1,300[1]	1,110	940	-80[1]
Total softwoods	268,720	7,200	71,310	121,960	68,250
Hardwoods:					
Red alder	70,460	500	18,300	32,400	19,260
Other hardwoods[2]	10,420	200	870	6,060	3,290
Total hardwoods	80,880	700	19,170	38,460	22,550
All species	349,600	7,900	90,480	160,420	90,800

[1] *Negative growth is the result of annual mortality exceeding gross annual growth.*

[2] *Includes bigleaf maple, black cottonwood, Oregon ash, Oregon white oak, Pacific madrone, and quaking aspen.*

Table 26. — Net annual growth of sawtimber on commercial forest land by species and ownership class, Olympic Peninsula, Washington, 1965 (International 1/4-inch scale)
(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	677,700	15,900	150,760	327,730	183,310
Western hemlock	561,590	-1,100[1]	157,110	298,160	107,420
Western redcedar	66,290	8,000	17,720	11,130	29,440
Sitka spruce	56,350	5,200	16,430	22,690	12,030
True firs	3,510	-2,200[1]	-12,990[1]	13,550	5,150
Other conifers	-5,320[1]	-9,300[1]	2,190	2,320	-530[1]
Total softwoods	1,360,120	16,500	331,220	675,580	336,820
Hardwoods:					
Red alder	211,670	3,100	46,690	71,860	90,020
Other hardwoods[2]	38,390	1,800	6,640	22,380	7,570
Total hardwoods	250,060	4,900	53,330	94,240	97,590
All species	1,610,180	21,400	384,550	769,820	434,410

[1] *Negative growth is the result of annual mortality exceeding gross annual growth.*

[2] *Includes bigleaf maple, black cottonwood, Oregon ash, and Pacific madrone.*

Table 27. — Net annual growth of sawtimber on commercial forest land by species and ownership class, Olympic Peninsula, Washington, 1965 (Scribner scale)
(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	473,520	11,700	104,600	232,310	124,910
Western hemlock	391,790	-800[1]	107,970	210,790	73,830
Western redcedar	40,420	5,900	11,310	4,910	18,300
Sitka spruce	39,590	3,800	11,550	15,970	8,270
True firs	-540[1]	-1,600[1]	-14,140[1]	10,960	4,240
Other conifers	-4,350[1]	-6,900[1]	1,370	1,470	-290[1]
Total softwoods	940,430	12,100	222,660	476,410	229,260
Hardwoods:					
Red alder	204,030	2,300	45,120	69,750	86,860
Other hardwoods[2]	37,510	1,300	6,890	21,800	7,520
Total hardwoods	241,540	3,600	52,010	91,550	94,380
All species	1,181,970	15,700	274,670	567,960	323,640

[1] *Negative growth is the result of annual mortality exceeding gross annual growth.*

[2] *Includes bigleaf maple, black cottonwood, Oregon ash, and Pacific madrone.*

Table 28. — Net annual growth of growing stock on commercial forest land by species and county, Olympic Peninsula, Washington, 1965
(In thousand cubic feet)

Species	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Softwoods:						
Douglas-fir	127,890	14,840	34,680	13,270	40,200	24,900
Western hemlock	115,100	41,060	59,860	10,180	3,670	330
Western redcedar	14,730	3,190	6,100	1,680	2,620	1,140
Sitka spruce	9,510	2,930	4,430	1,850	300	--
True firs	820	3,900	1,480	-5,390[1]	660	170
Other conifers	670	-500[1]	1,610	-390[1]	-50[1]	--
Total softwoods	268,720	65,420	108,160	21,200	47,400	26,540
Hardwoods:						
Red alder	70,460	7,630	31,400	6,940	7,560	16,930
Other hardwoods[2]	10,420	1,610	2,570	1,040	2,460	2,740
Total hardwoods	80,880	9,240	33,970	7,980	10,020	19,670
All species	349,600	74,660	142,130	29,180	57,420	46,210

[1] *Negative growth is the result of annual mortality exceeding gross annual growth.*

[2] *Includes bigleaf maple, black cottonwood, Oregon ash, Oregon white oak, Pacific madrone, and quaking aspen.*

Table 29. — Net annual growth of sawtimber on commercial forest land by species and county, Olympic Peninsula, Washington, 1965 (International 1/4-inch scale)
(In thousand board feet)

Species	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Softwoods:						
Douglas-fir	677,700	82,940	193,860	77,280	210,860	112,760
Western hemlock	561,590	238,060	271,210	27,260	23,230	1,830
Western redcedar	66,290	11,470	29,680	3,620	11,890	9,630
Sitka spruce	56,350	17,930	26,480	10,820	1,120	--
True firs	3,510	19,250	12,750	-33,780[1]	4,230	1,060
Other conifers	-5,320[1]	-3,700[1]	4,890	-2,710[1]	-3,800[1]	--
Total softwoods	1,360,120	365,950	538,870	82,490	247,530	125,280
Hardwoods:						
Red alder	211,670	18,820	77,670	24,630	45,090	45,460
Other hardwoods[2]	38,390	10,580	10,780	1,700	8,190	7,140
Total hardwoods	250,060	29,400	88,450	26,330	53,280	52,600
All species	1,610,180	395,350	627,320	108,820	300,810	177,880

[1] *Negative growth is the result of annual mortality exceeding gross annual growth.*

[2] *Includes bigleaf maple, black cottonwood, Oregon ash, and Pacific madrone.*

Table 30. — Average annual mortality of growing stock on commercial forest land by species and ownership class, Olympic Peninsula, Washington, 1961-65, inclusive
(In thousand cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	17,760	5,800	4,200	5,310	2,450
Western hemlock	62,550	14,200	24,140	20,510	3,700
Western redcedar	5,980	1,100	1,410	2,040	1,430
Sitka spruce	1,680	--	240	1,340	100
True firs	19,570	6,200	12,660	520	190
Other conifers	2,610	1,600	520	340	150
Total softwoods	110,150	28,900	43,170	30,060	8,020
Hardwoods:					
Red alder	5,750	200	290	3,490	1,770
Other hardwoods[1]	350	--	--	--	350
Total hardwoods	6,100	200	290	3,490	2,120
All species	116,250	29,100	43,460	33,550	10,140

[1] *Primarily bigleaf maple.*

Table 31. — Average annual mortality of sawtimber on commercial forest land by species and ownership class, Olympic Peninsula, Washington, 1961-65, inclusive (International 1/4-inch scale)
(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	74,050	39,100	16,860	12,960	5,130
Western hemlock	362,630	113,800	147,530	90,950	10,350
Western redcedar	29,470	6,300	7,790	10,050	5,330
Sitka spruce	8,720	--	990	7,730	--
True firs	132,230	46,300	83,570	2,360	--
Other conifers	15,360	10,800	3,780	--	780
Total softwoods	622,460	216,300	260,520	124,050	21,590
Hardwoods:					
Red alder	9,030	200	1,510	4,150	3,170
Other hardwoods[1]	2,010	--	--	--	2,010
Total hardwoods	11,040	200	1,510	4,150	5,180
All species	633,500	216,500	262,030	128,200	26,770

[1] *Primarily bigleaf maple.*

Table 32. — Average annual mortality of sawtimber on commercial forest land by species and ownership class, Olympic Peninsula, Washington, 1961-65, inclusive (Scribner scale)
(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	54,410	31,200	10,720	9,320	3,170
Western hemlock	280,960	90,800	114,950	67,780	7,430
Western redcedar	23,060	4,900	6,060	8,670	3,430
Sitka spruce	6,320	--	570	5,750	--
True firs	104,400	36,900	65,570	1,930	--
Other conifers	12,090	8,600	3,050	--	440
Total softwoods	481,240	172,400	200,920	93,450	14,470
Hardwoods:					
Red alder	8,720	200	1,460	3,990	3,070
Other hardwoods[1]	1,980	--	--	--	1,980
Total hardwoods	10,700	200	1,460	3,990	5,050
All species	491,940	172,600	202,380	97,440	19,520

[1] *Primarily bigleaf maple.*

Table 33. — Average annual mortality of growing stock on commercial forest land by species and county, Olympic Peninsula, Washington, 1961-65, inclusive
(In thousand cubic feet)

Species	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Softwoods:						
Douglas-fir	17,760	4,420	3,680	2,410	4,280	2,970
Western hemlock	62,550	11,960	23,730	24,510	2,350	--
Western redcedar	5,980	1,290	2,110	1,980	190	410
Sitka spruce	1,680	--	1,680	--	--	--
True firs	19,570	2,550	2,000	14,520	500	--
Other conifers	2,610	600	910	400	700	--
Total softwoods	110,150	20,820	34,110	43,820	8,020	3,380
Hardwoods:						
Red alder	5,750	660	3,900	490	360	340
Other hardwoods[1]	350	--	--	--	350	--
Total hardwoods	6,100	660	3,900	490	710	340
All species	116,250	21,480	38,010	44,310	8,730	3,720

[1] *Primarily bigleaf maple.*

Table 34. — Average annual mortality of sawtimber on commercial forest land by species and county, Olympic Peninsula, Washington, 1961-65, inclusive (International 1/4-inch scale)

(In thousand board feet)

Species	All counties	Clallam	Grays Harbor	Jefferson	Mason	Thurston
Softwoods:						
Douglas-fir	74,050	20,740	13,490	10,570	20,440	8,810
Western hemlock	362,630	69,030	127,230	152,970	13,400	--
Western redcedar	29,470	6,570	9,560	11,170	1,090	1,080
Sitka spruce	8,720	--	8,720	--	--	--
True firs	132,230	17,440	14,400	95,690	4,700	--
Other conifers	15,360	3,800	4,260	2,800	4,500	--
Total softwoods	622,460	117,580	177,660	273,200	44,130	9,890
Hardwoods:						
Red alder	9,030	3,070	3,510	1,630	--	820
Other hardwoods[1]	2,010	--	--	--	2,010	--
Total hardwoods	11,040	3,070	3,510	1,630	2,010	820
All species	633,500	120,650	181,170	274,830	46,140	10,710

[1] *Primarily bigleaf maple.*

Table 35. — Average annual mortality of growing stock and sawtimber on commercial forest land by softwoods and hardwoods, and by cause of death, Olympic Peninsula, Washington, 1961-65, inclusive

Species	Cause of death					
	All causes	Fire	Insects	Disease	Other[1]	Miscellaneous and unknown
	Thousand cubic feet					
Growing stock:						
Softwoods	110,150	300	2,050	3,460	80,470	23,870
Hardwoods	6,100	--	--	--	3,520	2,580
Total	116,250	300	2,050	3,460	83,990	26,450
	Thousand board feet, International 1/4-inch scale					
Sawtimber:						
Softwoods	622,460	([2])	16,640	22,510	458,110	125,200
Hardwoods	11,040	--	--	--	6,060	4,980
Total	633,500	([2])	16,640	22,510	464,170	130,180
	Thousand board feet, Scribner scale					
Sawtimber:						
Softwoods	481,240	([2])	13,180	17,710	353,060	97,290
Hardwoods	10,700	--	--	--	5,850	4,850
Total	491,940	([2])	13,180	17,710	358,910	102,140

[1] *Largely weather killed, some of which had been predisposed to windthrow or windbreak by root rot and heart rot.*

[2] *Less than 5,000 board feet.*

Table 36. — Net volume of salvable dead sawtimber on commercial forest land, by volume-per-acre and ownership classes, Olympic Peninsula, Washington, January 1, 1966

Volume per acre[1]	Total	National Forest[1]	All other owners[2]
	Million cubic feet		
Cubic feet:			
1 - 199	13.9	3.8	10.1
200 - 499	92.1	14.3	77.8
500 - 999	129.9	39.7	90.2
1,000 - 1,999	185.2	56.9	128.3
2,000 or more	158.3	82.0	76.3
Total	579.4	196.7	382.7
	Million board feet, Scribner scale		
Board feet:			
1 - 499	18.3	5.5	12.8
500 - 999	82.5	15.6	66.9
1,000 - 2,499	408.5	54.6	353.9
2,500 - 4,999	510.3	116.4	393.9
5,000 - 9,999	853.0	300.1	552.9
10,000 or more	1,257.0	919.7	337.3
Total	3,129.6	1,411.9	1,717.7

[1] *Based on 1/5-acre plots.*
[2] *Based on 1-acre sample plots.*

Table 37. — Net volume of salvable dead sawtimber on commercial forest land by volume-per-tree class and species group, Olympic Peninsula, Washington, January 1, 1966

Volume per tree	Total	Douglas-fir	Hemlock	Cedar	True firs	Other softwoods	Hardwoods
	Million cubic feet						
Cubic feet:							
1 - 49	96.2	23.5	36.2	18.4	7.5	5.2	5.4
50 - 99	85.1	17.6	34.0	10.4	13.5	5.6	4.0
100 - 499	309.6	39.9	152.7	63.4	44.4	9.2	--
500 or more	88.5	18.7	17.4	25.7	20.7	6.0	--
Total	579.4	99.7	240.3	117.9	86.1	26.0	9.4
	Million board feet, Scribner scale						
Board feet:							
1 - 149	237.9	69.1	81.5	45.2	13.9	16.7	11.5
150 - 499	481.5	85.7	192.5	70.2	68.2	27.5	37.4
500 - 2,499	1,471.3	179.7	800.6	245.6	197.6	47.8	--
2,500 or more	938.9	318.1	204.2	178.5	203.9	34.2	--
Total	3,129.6	652.6	1,278.8	539.5	483.6	126.2	48.9

Table 38. — Timber harvest by ownership class, Olympic Peninsula, Washington, 1950-67 (Scribner scale)

(In thousand board feet)

Year	All ownerships			Private[1]			State[1]			National Forest			Other public		
	Total	Live	Dead[2]	Total	Live	Dead[2]	Total	Live	Dead[2]	Total	Live	Dead[2]	Total	Live	Dead[2]
1950	1,096,330	([3])	([3])				795,896	([3])	([3])	218,700	([3])	([3])	81,734	([3])	([3])
1951	1,085,622	([3])	([3])				743,922	([3])	([3])	241,700	([3])	([3])	100,000	([3])	([3])
1952	1,085,693	969,508	116,185				672,820	656,192	16,628	294,400	196,772	97,628	118,473	116,544	1,929
1953	939,105	([4])	([4])				448,606	394,752	53,854	369,100	([3])	([3])	121,399	121,048	351
1954	989,721	922,742	66,979				527,004	496,839	30,165	345,900	310,100	35,800	116,817	115,803	1,014
1955	1,143,691	983,314	160,377	576,067	543,519	32,548	140,332	138,276	2,056	250,179	124,406	125,773	177,113	177,113	--
1956	1,175,976	1,128,172	47,804	658,794	638,782	20,012	136,386	134,777	1,609	267,300	244,700	22,600	113,496	109,913	3,583
1957	926,230	883,079	43,151	543,957	524,756	19,201	71,944	69,507	2,437	249,964	228,451	21,513	60,365	60,365	--
1958	878,829	831,242	47,587	451,063	442,424	8,639	82,303	80,217	2,086	268,928	233,610	35,318	76,535	74,991	1,544
1959	1,177,402	1,124,926	52,476	662,073	636,682	25,391	81,765	80,872	893	322,299	297,691	24,608	111,265	109,681	1,584
1960	1,148,990	1,094,313	54,677	687,591	658,599	28,992	93,683	93,014	669	250,929	229,629	21,300	116,787	113,071	3,716
1961	1,049,286	1,001,146	48,140	607,680	577,843	29,837	100,071	97,649	2,422	219,890	206,368	13,522	121,645	119,286	2,359
1962	1,078,226	1,047,887	30,339	567,448	558,236	9,212	114,663	114,272	391	273,300	253,200	20,100	122,815	122,179	636
1963	1,298,262	1,179,190	119,072	655,428	548,961	106,467	147,093	142,947	4,146	361,400	357,500	3,900	134,341	129,782	4,559
1964	1,544,033	1,261,053	282,980	791,669	634,882	156,787	142,657	138,631	4,026	403,800	286,900	116,900	205,907	200,640	5,267
1965	1,539,236	1,420,863	118,373	715,757	664,961	50,796	250,409	249,807	602	369,800	308,400	61,400	203,270	197,695	5,575
1966	1,496,903	1,458,357	38,546	825,399	815,672	9,727	183,798	182,837	961	300,214	280,714	19,500	187,492	179,134	8,358
1967	1,440,086	1,422,100	17,986	720,139	715,807	4,332	225,482	223,380	2,102	291,500	281,749	9,751	202,965	201,164	1,801

[1] *Data for private ownership combined with State ownership for 1950-54.*

[2] *Includes snags and down material existing prior to initial logging. Salvage of this material does not constitute drain on the volume of the forest inventory of live trees.*

[3] *Data not available by live and dead.*

[4] *Incomplete data.*

Accuracy of the current inventory data

Forest Land Area and Timber Volume

The estimates of forest land area and timber volume in the Olympic Peninsula were derived by sampling and consequently have sampling errors. Sampling errors have been computed for the estimates of commercial forest land area, noncommercial forest land area, net cubic-foot volume of growing stock, and net board-foot volume (International 1/4-inch scale) of sawtimber. These are presented in table 39 as a percent of the estimated total at the 68-percent and 95-percent probability levels. They may be interpreted as meaning that the odds are two out of three for 68-percent probability or 19 out of 20 for 95-percent probability, that if a 100-percent inventory had been taken, using the same methods, the results would have been within the ranges shown. For example, the estimate of total commercial forest land area from a 100-percent inventory would be expected to fall within plus or minus 1.0 percent of 3,105,000 acres, unless a one in three chance of sampling has occurred.

In addition to measurable sampling errors, there may be other nonsampling errors due to mistakes in judgment, measurement, and compilation. The magnitude of errors from these sources cannot be determined. However, such errors are kept to a minimum through training, supervision, field checking, and complete editing and machine verification in compiling the data.

The sampling error of any breakdown of these totals will be substantially greater than for the total. The smaller the breakdown, the larger the sampling error. An approximation of the increasing sampling error can be obtained from table 40, which shows the sampling error associated with smaller estimates.

Table 39. — Sampling errors of estimates of forest area and timber volume, Olympic Peninsula, Washington, January 1, 1966

Item	Estimated total	Sampling error in percent	
		68-percent probability	95-percent probability
Commercial forest land	3,105,000 acres	±1.0	±1.9
Noncommercial forest land	925,000 acres[1]	±11.6	±21.6
Volume:			
Growing stock	15,254 million cubic feet	±2.1	±4.1
Sawtimber (International 1/4-inch scale)	81,464 million board feet	±2.6	±5.2

[1] *Of the estimated 925,000 acres of noncommercial forest land on the Olympic Peninsula, 775,000 were classified by type-mapping procedures, hence have no associated sampling error.*

Table 40. — Approximate sampling error by size of estimate, Olympic Peninsula, Washington, January 1, 1966

Commercial forest land		Growing stock		Sawtimber	
Area	Sampling error[1]	Volume	Sampling error[1]	Volume	Sampling error[1]
Thousand acres	*Percent*	*Million cubic feet*	*Percent*	*Million board feet, International 1/4-inch scale*	*Percent*
3,105	1.0	15,254	2.1	81,464	2.6
776	2.0	7,474	3.0	61,189	3.0
345	3.0	4,204	4.0	34,419	4.0
194	4.0	2,691	5.0	22,028	5.0
124	5.0	673	10.0	5,507	10.0
31	10.0	299	15.0	2,448	15.0
14	15.0	168	20.0	1,377	20.0
8	20.0	108	25.0	881	25.0
5	25.0	75	30.0	612	30.0
3	30.0	42	40.0	344	40.0
		27	50.0	220	50.0
		7	100.0	55	100.0

[1] *By random sampling formula; 68-percent probability.*

Forest Survey procedures

This inventory of the forests of the Olympic Peninsula combines data from the Olympic National Forest inventory project, a very small parcel of the Snoqualmie National Forest in Thurston County (323 acres), and the Forest Survey project for all lands outside the National Forests. The National Forest lands were inventoried in 1963 and the outside National Forest lands in 1965. No updating was done to bring data to a common date.

National Forest Lands

Field plots were distributed on a systematic grid at 1.7-mile intervals on all National Forest lands, except the Shelton Working Circle where a double grid was used, placing plots at 0.85-mile intervals. Plots consisted of three 1/5-acre subplots. Estimates of area, volume, growth, and mortality were obtained from these plots.

Gross annual growth on National Forest land is for the period 1953 to 1963, as estimated from increment borings of a subsample of trees on each plot. Annual mortality is for the period 1958 to 1963, estimated by postdating time of death of dead trees on each plot. The Olympic National Forest was inventoried the year after the Columbus Day storm of 1962, and to avoid overestimating mortality, trees killed during that storm were identified on the plot tally and excluded from the mortality totals.

Outside National Forest Lands

A double sampling design was used for lands outside the National Forests. First, aerial photo sample plots were distributed systematically across the area. Photo plots were classified into one of three major land classes — commercial forest, noncommercial forest, and nonforest — and the commercial forest plots were further classified into stand volume classes. All photo plots were classified by kind of owner from public records. About 7,500 photo plots were examined. The second stage consisted of a basic systematic grid of field plots 3.4 miles apart with supplemental plots added. There were 589 field plots located at photo plot locations, each consisting of 10 sample points distributed systematically over an acre. The variable-radius plot sampling principle was used at each point to select the trees to be tallied. Where no trees were tallied, a ground cover class was recorded. Summations of the 10-point tally expressed the resources and conditions for that acre and were used with the photo sample to provide area, volume, growth, and mortality statistics. In Clallam and Jefferson Counties, in addition to the two-stage sample discussed above, previously established 1/5-acre plots were remeasured. Actual measured growth and mortality from these plots were used for these counties. For the remaining counties, increment core readings were taken for growth, and the time of death was postdated in estimating mortality.

Annual growth on lands outside National Forest is for the year 1965, estimated by regression equations. Variables included: d.b.h., d.b.h. minus average stand diameter, tree age, basal area per acre, site index, crown ratio, and several others. Diameter for 1 year ago was computed for all growing-stock trees, and net volume was computed for both present and past diameters. Gross growth was obtained by subtracting past from present net volume.

Annual mortality for lands outside National Forest is for the period 1961 to 1965. Mortality on these lands caused by the Columbus Day storm of 1962 is included because by 1965 it was not possible to differentiate trees killed in 1962 from trees killed before or after that date. Damage by the Columbus Day storm was generally light in the Olympic Peninsula, and for this reason, the growth and mortality figures are probably about the same as normal trends.

Definition of terms

Land Area

Total Land Area

Includes dry land and land temporarily or partially covered by water such as marshes, swamps, and river flood plains; streams, sloughs, and canals less than one-eighth mile wide; and lakes, reservoirs, and ponds less than 40 acres in area.

Forest Land Area

Land at least 10 percent stocked by trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Minimum area of forest land recognized is 1 acre.

Nonforest Land Area

Land that has never supported forests and lands formerly forested where use for timber management is precluded by development for other uses. Included are areas used for agricultural crops, improved pasture, residential areas, city parks, improved roads of any width and right-of-way clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and other nonforest strips must be more than 120 feet wide, and clearings, etc., more than 1 acre in size, to qualify as nonforest land.

Forest Land Classes

Commercial Forest Land Area

Forest land which is producing or capable of producing industrial wood and not withdrawn from timber utilization.

Noncommercial Forest Land Area

Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions, and productive public forest land withdrawn from commercial timber use through statute or administrative regulation.

Productive-reserved. Public forest land withdrawn from timber utilization through statute, ordinance, or administrative order, but which otherwise qualifies as commercial forest land. Also included are forest lands managed exclusively for Christmas tree production.

Unproductive. Forest land incapable of yielding crops of industrial wood products because of adverse site conditions such as sterile soil, poor drainage, high elevation, steepness, and rockiness.

Forest Types

Forest types are determined on the basis of species plurality of all live trees that contribute to stocking, considering both size and spacing.

Tree Classes

Growing-Stock Trees

Sawtimber trees, poletimber trees, saplings, and seedlings; that is, all live trees except cull trees.

Acceptable trees. Growing-stock trees of commercial species that meet specified standards of size and quality, but not qualifying as desirable trees.

Desirable trees. Growing-stock trees of commercial species (a) having no serious defects in quality limiting present or prospective use for timber products, (b) of relatively high vigor, and (c) containing no pathogens that may result in death or serious deterioration before rotation age.

Sawtimber trees (11.0 inches d.b.h. and larger). Live trees of commercial species. Softwood trees must contain at least one 12-foot saw log with a top diameter not less than 6 inches inside bark; hardwood trees must contain at least one 8-foot saw log with a top diameter not less than 8 inches inside bark. At least 25 percent of the board-foot volume in a tree must be free of defect for either softwoods or hardwoods.

Poletimber trees (5.0 to 10.9 inches d.b.h.). Live trees of commercial species not less than 50 percent sound on a cubic-foot basis and with no disease, defects, or deformities which are likely to prevent them from becoming growing-stock sawtimber trees.

Sapling and seedling trees (less than 5.0 inches d.b.h.). Live trees of commercial species with no disease, defects, or deformities which are likely to prevent them from becoming growing-stock poletimber trees.

Nongrowing-Stock Trees

Cull trees. Trees of noncommercial species and trees of commercial species which are too defective or which are unlikely to become growing-stock trees due to deformity, disease, low vigor, etc.

Sound cull trees. Trees of noncommercial species, or with excessive defect due to form, roughness, etc.

Rotten cull trees. Trees with excessive defect due primarily to rot.

Mortality trees. Trees of commercial species which have died from natural causes within the past 5 years and which were not cull trees at the time of death.

Salvable dead trees. Standing or down dead trees of commercial species 11.0 inches or more in diameter that contain 25 percent or more of sound volume and at least one merchantable 16-foot log if a softwood or one merchantable 8-foot log if a hardwood.

Stand-Size Classes

Sawtimber Stand

Stand at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber and poletimber trees, and with sawtimber stocking equal to or greater than poletimber stocking.

Large sawtimber stand. Stand in which the majority of the sawtimber stocking is in trees 21.0 inches d.b.h. and larger.

Small sawtimber stand. Stand in which the majority of the sawtimber stocking is in trees from 11.0 to 20.9 inches d.b.h.

Poletimber Stand

Stand at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber and poletimber trees, and with poletimber stocking exceeding sawtimber stocking.

Sapling and Seedling Stand

Stand at least 16.7 percent stocked with growing-stock trees, with more than half of this stocking in saplings and/or seedlings.

Nonstocked Area

An area of commercial forest land less than 16.7 percent stocked with growing-stock trees.

Stocking

Stocking is an expression of the extent to which growing space is effectively utilized by present or potential growing-stock trees of commercial species. "Percent of stocking" is synonymous with "percentage of growing space occupied" and means the ratio of actual stocking to full stocking for comparable sites and stands. Basal area is used as a basis for measuring stocking.

"Stocking percentages" express current area occupancy in relation to specified standards for full stocking based on number, size, and spacing of trees considered necessary to fully utilize the forest land.

Full utilization of the site is assumed to occur over a range of basal area. As an interim guide, 60 percent of the normal yield table values has been used to establish the lower limit of this range which represents full site occupancy. This is called 100-percent stocking. The upper limit to full stocking has been set at 132 percent. Sites with less than 100-percent stocking represent understocking with less than full site occupancy. Overstocking is characterized by sites that have over 132-percent stocking.

Age

Stand age. Stand age is based upon growing-

stock stocking. In order for a stand to be even aged, a majority of the growing-stock stocking must be in two adjacent age classes. Stands that do not meet this criterion are classified as uneven aged, under or over rotation age.

Rotation age. The period of years between establishment of a stand of timber and the time when it is considered ready for cutting. Rotation age in softwood stands is 100 years; in hardwood stands, it is 50 years.

Old-growth sawtimber stand. Sawtimber stand in which 50 percent or more of the growing stock is in trees at least 140 years old.

Young-growth sawtimber stand. Sawtimber stand in which more than 50 percent of the growing stock is in trees less than 140 years old.

Timber Volume

Live Sawtimber Volume

Net volume in board feet of live sawtimber trees of commercial species. Net volume equals gross volume less deduction for rot, sweep, crook, and other defects that affect use for lumber.

Scribner rule. The common board-foot log rule used in determining volume of sawtimber in Washington. Scribner volume in the Olympic Peninsula is measured in terms of 32-foot logs.

International 1/4-inch rule. The standard board-foot log rule adopted nationally by the Forest Service for the presentation of Forest Survey volume statistics.

Growing-Stock Volume

Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4.0-inch top (of central stem) outside bark. Net volume equals gross volume less deduction for rot and missing bole sections.

All Timber Volume

Net volume in cubic feet of live and salvable dead sawtimber trees and poletimber trees of commercial species, and cull trees of all species from stump to a minimum 4.0-inch top outside bark.

Industrial Wood

All roundwood products, except fuelwood.

Growth

Net Annual Growth

The increase in volume of a specified size class for a specific year. (Components of net annual growth include the increment in net volume of trees at the beginning of the specific year surviving to the year's end plus volume of trees reaching the size class during the year minus the volume of trees that died during the year minus the net volume of trees that became culls during the year.)

Ownership Classes

National Forest Lands

Federal lands which have been designated by Executive order or statute as National Forests or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones title III lands.

Other Public Lands

Federal lands other than National Forests, including lands administered by the Bureau of Land Management, Bureau of Indian Affairs, and miscellaneous Federal agencies, and lands owned by States, counties, and local public agencies, or lands leased by these governmental units for more than 50 years.

Forest Industry Lands

Lands owned by companies or individuals operating wood-using plants.

Farmer-Owned Lands

Lands owned by operators of farms.

Miscellaneous Private Lands

Privately owned lands other than forest industry or farmer-owned lands.

Normal Yield Table

A normal yield table is a tabulation of the volume, basal area, number of trees, etc., per acre found in fully stocked stands on specified sites at specified ages.

Tree species

Principal tree species found on the commercial forest land on the Olympic Peninsula include:

Softwoods:
- Alaska cedar (*Chamaecyparis nootkatensis*)
- Douglas-fir (*Pseudotsuga menziesii*)
- Grand fir (*Abies grandis*)
- Lodgepole pine (*Pinus contorta*)
- Mountain hemlock (*Tsuga mertensiana*)
- Pacific silver fir (*Abies amabilis*)
- Sitka spruce (*Picea sitchensis*)
- Subalpine fir (*Abies lasiocarpa*)
- Western hemlock (*Tsuga heterophylla*)
- Western redcedar (*Thuja plicata*)
- Western white pine (*Pinus monticola*)

Hardwoods:
- Bigleaf maple (*Acer macrophyllum*)
- Black cottonwood (*Populus trichocarpa*)
- Oregon ash (*Fraxinus latifolia*)
- Oregon white oak (*Quercus garryana*)
- Pacific madrone (*Arbutus menziesii*)
- Red alder (*Alnus rubra*)
- Willow (*Salix* spp.)

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PNW-29	1968 Oregon Timber Harvest	1969
PNW-28	Animal Damage to Conifers on National Forests in the Pacific Northwest Region	1969
PNW-27	1967 Oregon Timber Harvest	1968
PNW-26	The Timber Resources of Humboldt County, California	1968
PNW-25	1967 Washington Timber Harvest	1968
PNW-24	Timber Resource Statistics for Central Oregon	1968
PNW-23	Preliminary Timber Resource Statistics for Humboldt County, California, January 1, 1967	1968
PNW-22	1966 Oregon Timber Harvest	1967
PNW-21	1966 Washington Timber Harvest	1967
PNW-18	1965 Washington Timber Harvest	1966
PNW-17	Forest Industries of Eastern Washington	1966
PNW-16	1965 Oregon Timber Harvest	1966
PNW-15	Timber Resource Statistics for Southwest Washington	1965
PNW-14	1964 Washington Timber Harvest	1965
PNW-13	1964 Oregon Log Production	1965
PNW-12	The Timber Situation and Outlook for Northwest Oregon	1965
PNW-11	Hardwood Timber Resources of the Douglas-fir Subregion	1965
PNW-10	Forest Statistics for West-Central Oregon	1965
PNW-9	Timber Resource Statistics for the Pacific Northwest	1965
PNW-8	Forest Statistics for Southwest Oregon	1964
PNW-7	Forest Statistics for Northwest Oregon	1964
PNW-6	1962 Washington Log Production	1963
PNW-5	Forest Statistics for Chelan and Douglas Counties, Washington	1963
PNW-4	Forest Statistics for Northeast Washington	1963
PNW-3	Toward Complete Use of Eastern Oregon's Forest Resources	1963
PNW-2	1962 Oregon Log Production	1963
PNW-1	1961 Washington Log Production	1963

Research Papers:

PNW-84	Projected Developments of the Timber Economy of the Columbia-North Pacific Region	1969
PNW-28	Manpower Use in the Wood-Products Industries of Oregon and Washington 1950-63	1965
PNW-5	Timber Trends in Western Oregon and Western Washington	1963

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USDA FOREST SERVICE RESOURCE BULLETIN PNW-32
1970

Forest Resources of the Susitna Valley, Alaska

by
KARL M. HEGG

CIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
REST SERVICE
U.S. DEPARTMENT OF AGRICULTURE
TITUTE OF NORTHERN FORESTRY
JUNEAU, ALASKA

Foreword

This report summarizes the data from the first intensive inventory of the forests in the Susitna Valley, Alaska, conducted during the period 1964-65.

The primary purposes of the inventory were to determine the total area of forested lands, the commercial forest area and timber volume, and the condition and growth of this resource, and to report on these findings. *Board-foot volumes, unless otherwise stated, are derived from the International 1/4-inch log rule* (defined on p. 25.)

Past estimates of timber volumes and forest areas for the Susitna Valley have been based largely on general knowledge or low-intensity cruises and surveys. In 1916, George L. Drake, of the U.S. Forest Service, made a brief reconnaissance trip to the Cook Inlet-Susitna River area and estimated area and volume remarkably close to present estimates. In more recent years, several localized areas have been cruised by the State Branch of Forestry and the Bureau of Land Management. The first extensive inventory of the valley was made by the Forest Survey in 1961 as part of a more generalized inventory of interior Alaska (Hutchison 1967).[1] This inventory was statistically valid for the entire region—not for the individual areas or drainages. Even so, estimates compiled for the Susitna drainage were, with allowance for differing areas encompassed, much the same as we are now reporting.

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[1] Names and dates in parentheses refer to Literature Cited, p. 22.

Acknowledgments

This forest inventory was a joint effort of the Alaska State Division of Lands, Department of Natural Resources, and the Institute of Northern Forestry, Pacific Northwest Forest & Range Experiment Station, Forest Service, U.S. Department of Agriculture, at Juneau, Alaska. Aerial photo coverage was provided by the State Division of Lands and the U.S. Department of Interior, Bureau of Land Management. Fieldwork was by crews from the State Division of Lands and the Forest Survey of the Institute of Northern Forestry. Data compilation and reporting has been the responsibility of the Forest Survey. Overall supervision was by O. K. Hutchison, field and office direction by K. M. Hegg, and data processing by J. D. Born. Participants in the fieldwork were: R. M. Dippold, D. Murphy, C. Ellis, J. Spaulding, A. Sundt, and E. Veijalainen.

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Highlights

FOREST AREA

- The Susitna Valley inventory totals 5,610,000 acres (2,270,000 hectares).
- Forests cover 3,200,700 acres (1,295,000 hectares).
- Forest land classed as commercial[2] totals 1,295,000 acres (524,000 hectares).
- Paper birch type occupies 64 percent of the commercial forest area; spruce, 26 percent; balsam poplar-cottonwood, 9 percent; and aspen, 1 percent.
- Of the commercial forests, 67 percent is classed as sawtimber; 22 percent as poletimber; 10 percent as seedling and sapling stands; and 1 percent is rated nonstocked.

FOREST VOLUME

- Net volume in growing-stock trees totals 1.4 billion cubic feet (40,666,000 cubic meters) or 4.1 billion board feet. An additional 58 million cubic feet of sound wood is in rough and salvable dead trees.
- Sawtimber-size trees have 68 percent and poletimber-size trees 32 percent of the growing-stock volume.
- Cubic-foot volume distribution by species is: paper birch, 42.5 percent; spruce, 31.6 percent; cottonwood, 24.4 percent; and aspen, 1.5 percent.
- Noncommercial stands, comprised largely of small size trees, have about 1 billion cubic feet (28,300,000 cubic meters) or 1 billion board feet of timber.

STAND CONDITIONS

- All commercial stands have a potential increment of 20 to 85 cubic feet per acre per year.
- Rough and rotten trees, inhibiting vegetation, and nonstocked areas occupy 36 percent of the commercial forest land.
- Growth rates are low—total net annual growth is only 2.2 percent of net volume but averages 25 cubic feet per acre per year (1.75 cubic meters per hectare).

[2] For definitions of terms see "Terminology," p. 24.

Physical Description

GEOGRAPHICAL LOCATION

The Susitna Valley inventory unit lies in south-central Alaska between longitude 147° and 152° W. and latitude 61° and 62°30′ N.—an area approximately 70 by 100 miles in extent (fig. 1). Except for Cook Inlet on the south, it is completely surrounded by mountains: the Aleutian and Alaska Ranges on the west and north, and the Talkeetna and Chugach Mountains on the east.

PHYSIOGRAPHY

Underlying bedrock in the basin is primarily from the Tertiary period sediments. Older Jurassic period granitic intrusives are represented in the Talkeetna Mountains, Mount Susitna, Mount Beluga, and parts of the Alaska Range. Uplifted marine sediments make up other parts of the Alaska Range. During the Pleistocene epoch and up to about 10,000 years ago, glaciers covered most of the present lowland area, and much of the present topography is a result of glacial depositions. These deposits consist of detritus and gravel that have been incised by river erosion in their upper reaches and are interspersed with lakes, muskegs, and bogs on the older bench terraces. Continuing erosion during and since the Pleistocene epoch has resulted in narrow, gradually widening, flood plain terraces along the larger rivers culminating in the broad apron of the Susitna River and the

Prepared from:
ALASKA, MAP C
U.S. Geological Survey
Washington, D.C. 1953
Inventory Area
ARCTIC OCEAN
BEAUFORT SEA
BROOKS RANGE
SEWARD PENINSULA
SOVIET UNION
UNITED STATES
Bering Strait
Wrangell I
Barrow
Pt Barrow
Point Hope
Kotzebue
Kobuk
Selawik
Noatak R
Kotzebue Sound
Baker Cape
Kivalina
Wainwright
Wiseman
Umiat
Colville R
Chandalar R
Porcupine R
Fort Yukon
Arctic Circle
Arctic Village
Old Crow
Mackenzie Bay
Mackenzie
Kuparuk R
Colville R
Canning R
Sagavanirktok R
Prudhoe Bay
Point Barrow
Cape Lisburne
Icy C
Kotzebue Bay
Hotham Inlet
Kobuk R
Selawik L
Noatak
Kivalina
Wainwright
Utukok R
Kukpowruk R
Kuk R
Kiwalik R
Tisuaq R
Nulato
Yukon R
Ruby
Tanana
Nenana
Fairbanks
Delta Junc
Tok Junc
Eagle
Fairbanks
Dawson
Circle
Livengood
Selkirk
Nome
Norton Sound
St Lawrence I
St Michael
Ophir
McGrath
Iditarod
Marshall
Holy Cross
Anvik
Yukon R
Tanana R
Kuskokwim R
Kuskokwim Bay
Bethel
St Matthew I
Nunivak I
Platinum
Nushagak
Nushagak Bay
Bristol Bay
Hagemeister I
Pribilof Islands
Togiak B
Alaska Peninsula
Shelikof Strait
Kodiak
Kodiak I
Homer
Kenai Peninsula
Cook Inlet
Kachemak Bay
Seldovia
Port Graham
Anchorage
Valdez
Cordova
Katalla
Controller Bay
Yakutat
Mt McKinley Natl Park
Mt McKinley
Gulkana
Glennallen
Copper Center
Chitina
McCarthy
Mt St Elias
Alaska Range
Alaska Highway
Haines Jct
Whitehorse
Yukon Territory
British Columbia
Haines
Skagway
Juneau
Canada
United States
Prince Rupert
Dixon Entrance
Cross Sound
Yakutat Bay
Gulf of Alaska
Aleutian Islands
Unimak I
Unga
Shumagin Is
Fox Is
Dutch Harbor
Unalaska I
Atka I
Islands
Pacific Ocean
100 0 100 200 300 400 500 Miles
100 0 100 200 300 400 500 Kilometers

shallow mud flats of Cook Inlet (Brooks 1911; Capps 1913, 1927,-- p. 141-172, 1929, 1935, 1940; and Capps and Tuck 1933).

Drainage from this area is by the Susitna River and its tributaries: the Yentna-Skwentna-Kahiltna, the Chulitna, the Talkeetna, and the Kashwitna Rivers. All, except the Susitna River, originate in glaciers as fast-flowing streams carrying large loads of gravel, sand, and silt. A second drainage system, the Matanuska-Knik-Chickaloon, with headwaters in the Chugach and Talkeetna Mountains, also drains into the Knik Arm at Cook Inlet. Together, these systems drain a total area of 17 million acres.

CLIMATE

The climate of the valley can be best described as moderate continental, opposed to the subarctic climate of the remainder of interior Alaska. Temperatures are much the same in most of the lowland area. Mean annual temperatures are 32° to 35° F. with the months of June, July, and August having monthly temperature means in excess of 55° F. January temperatures average nearly the same as in southern Minnesota (9° to 14° F.). Mean temperature in July (58° F.) is equal that of Duluth, Minnesota.

Precipitation is also quite uniform over the valley. Four weather recording stations in the valley—Susitna, 20 miles north of the mouth of the Susitna River; Willow, north 40 miles; Talkeetna, north 80 miles; and Skwentna, northwest 50 miles—receive about 30 inches of precipitation annually. Elevations of these stations are less than 350 feet. Only with increasing elevation does this uniformity change—Curry, north 100 miles at 600 feet, has 44 inches of annual precipitation.[3]

SOILS

Soil studies in the Susitna Valley are largely in the reconnaissance stage. Soil maps are available for the Matanuska Valley and a fairly narrow section of the Susitna River to above Talkeetna, but are generalized elsewhere. The soils of the area as described by Samuel Rieger, Alaska State soil scientist, Soil Conservation Service, in a personal communication:

> Basically, the entire region is an association of fairly thin Spodosols (Podzols) developed in loess (mixed with ash) over coarse drift, Histosols (muskeg), and wet mineral soils. There are some exceptions among the well-drained soils: Entisols (Regosols) in very young loess at the eastern end of the Matanuska Valley and on floodplains of the major rivers, and very shallow stony soils in alpine areas . . .

Figure 2 portrays the distribution of these soil orders. The weak to well-developed Spodosols (areas 2 and 3 on fig. 2) and Entisols (area 1 on fig. 2) support the best forest stands. Good stands are also found growing on the strongly developed Spodosols (area 4), but an open-stocked appearance is more typical. The better stands found on those soils probably reflect the better drainage. A loose relationship between soils and forest type may be seen by comparing the soils map (fig. 2) and the forest-type map (fig. 3). (For expanded descriptions of the associated soil areas, see "Appendix," page 24.)

Forest Description

This first intensive survey of the Susitna Valley classified all forest land by growth capacity. Forest land with a mean annual growth productivity or potential mean annual increment (MAI) of less than 20 cubic feet per acre was classed as noncommercial. The noncommercial forest land was further classified as producing less than 15 cubic feet annually or producing between 15 to 20 cubic feet annually. The latter class is referred to as subcommercial.

NONCOMMERCIAL FOREST LAND

The noncommercial forest area producing less than 15 cubic feet per acre per year totals 1,322,000 acres. These are generally areas of poorly drained lowland black spruce and paper birch, and the subalpine forests of white and black spruce (fig. 4).

The gross volume in these stands is about 500 million cubic feet. There is some local use of wood material from these lands, but as economic timber-producing units they have little value.

SUBCOMMERCIAL FOREST LAND

There are 584,000 acres of subcommercial forest land with the potential of producing at a rate of between 15 and 20 cubic feet per acre per year. This small difference in growth rates could not be determined accurately on the photos and had to be made from ground measurements.

[3]From "Climatological Data" U.S. Department of Commerce, Environmental Science Services Administration.

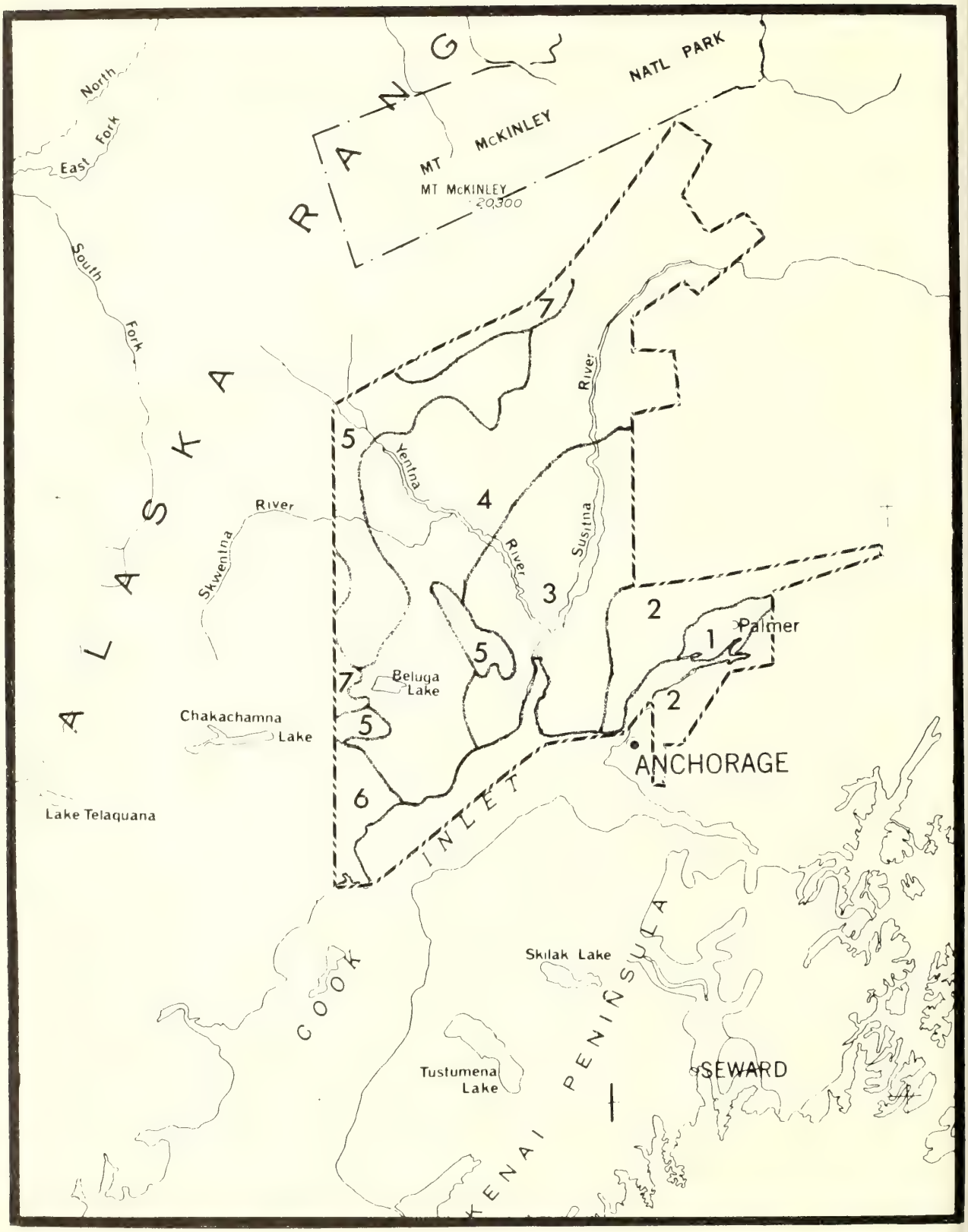

Figure 2.—Generalized soil map of the inventory area: (1) dominantly Entisols (shallow to deep silty soils); (2) weakly developed shallow Spodosols with Aquepts and Histosols; (3) fairly well-developed loessial Spodosols on uplands and Entisols on flood plains with Aquepts and Histosols; (4) strongly developed loessial Spodosols on uplands, Entisols on flood plains and Histosols; (5) Andepts (shallow silty) and thin Spodosols; (6) Aquepts or Aquic Psamments in glacial outflows; (7) rough mountainous land and glaciers.

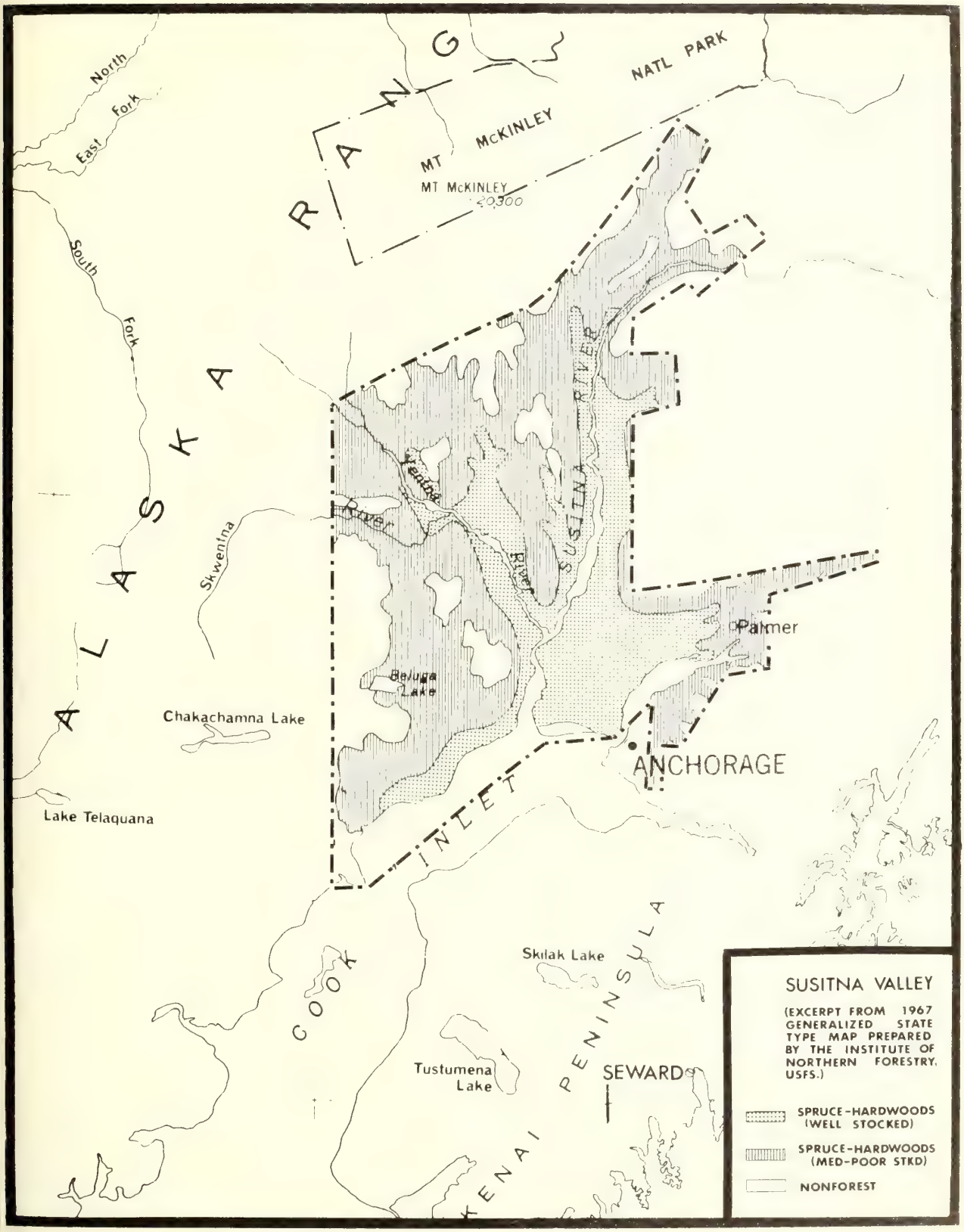

Figure 3.—Forest type map of Susitna Valley.

Figure 4.—This is typical of much of the 1,322,000 acres of noncommercial forest land. Generally these areas are poorly drained and have many stems per acre.

These stands in conjunction with the better stands nearby are potentially harvestable and should be considered in the future management picture. However, these subcommercial data should be used with caution because no sampling errors can be derived for the estimates. Statistical data were produced for stands with more than 15-cubic-foot MAI and more than 20-cubic-foot MAI and are not correctly subtractive.

Nearly all (90 percent) of the subcommercial area and volume is classified as birch type. All of these stands have volumes of less than 5,000 board feet per acre (2,000 cubic feet); about half are classed as sawtimber (softwood >9.0-inch d.b.h. and hardwoods >11.0-inch d.b.h.).

The subcommercial stands have more birch and less spruce and cottonwood than the commercial stands (table 1). Table 2 shows that the trees in subcommercial stands tend to be smaller in diameter than those in commercial stands, and table 3 shows the considerable difference in growth between the two classes.

COMMERCIAL FOREST LAND

Commercial stands total 1,295,000 acres. Most occur below 1,000-foot elevation and within 80 miles of tidewater. This acreage supports 353 million growing-stock trees (live merchantable trees of commercial species 5.0-inch d.b.h. and larger) having a gross volume of 1.7 billion cubic feet and a net volume of 1.4 billion cubic feet. An additional 58 million net cubic feet of sound wood is in rough and salvable dead trees. The cubic- and board-foot volumes were developed using equations from "Volume tables for trees of interior Alaska" (Haack 1963).

The highest volume and most productive stands are on the well-drained river flood plains. Stand composition is chiefly a black cottonwood-balsam poplar mixture. Pleistocene epoch terraces, set back from the major rivers, support the better stands of birch and birch-spruce mixtures. Chief among these are the Talkeetna River, Peters Creek, and Shell Lake-Hewitt Lake stands. Eolian soils of the Matanuska Valley support good stands of birch and the only aspen seen in the valley. Most of the Matanuska stands have developed after fires and are generally pole-sized with occasional sawtimber trees (figs. 5, 6). Scattered elsewhere are pockets of good timber intermixed with black spruce muskegs. Chief among these are the flats around the mouth of the Susitna River, along the western shores of Cook Inlet, and the lowlands between the Susitna and Yentna-Kahiltna Rivers.

Ownership Patterns

Since statehood, Alaska has selected nearly 17 million acres of land. Of this total, 5.1 million acres is in the Susitna Valley. The policy of the State has been to dedicate only certain select areas for forest production. No data are available for the dedicated forest land within the Susitna Valley although about 250,000 acres have been classified throughout the

Table 1.–Distribution of cubic-foot volume by species, Susitna Valley, Alaska, 1965

Class	Spruce	Cottonwood	Birch	Aspen	Total
	Percent				
Subcommercial	17.6	28.4	52.7	1.3	100.0
Commercial	21.1	33.5	43.8	1.6	100.0

Table 2.–Distribution of cubic-foot volume by diameter class, Susitna Valley, Alaska, 1965

Class	Diameter class (inches)							
	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9
	Percent (cumulative)							
Subcommercial	23.5	43.7	61.5	75.4	83.2	86.2	90.0	92.2
Commercial	20.4	40.6	57.2	71.2	79.7	83.5	87.8	90.6

Table 3.–Volume and growth per acre for subcommercial and commercial land classes, Susitna Valley, Alaska, 1965

Class	Net volume per acre		Growth per acre	
	Board feet[1]	Cubic feet	Board feet[1]	Cubic feet
Subcommercial	1,577	794	33	19
Commercial	3,130	1,109	95	25

[1] *International 1/4-inch scale.*

Figure 5.—Overstocked birch seedlings and saplings established after a fire, Matanuska Valley.

Figure 6.—Pole-size aspen with a white spruce understory, Matanuska Valley.

State. Forest lands not in private ownership and classified for nonforest uses are available for cutting but are not managed as a renewable resource. Volumes and areas shown in this report disregard any ownership breakdown or reserve status and are for all commercial forest lands in the area. Because of the large State ownership in the valley, we can probably assume the data in this report are for State forests with less than 5 percent for private holdings.

Stand Condition

Understocking is a major problem in the forests of this inventory unit. Thirty-six percent of the commercial forest land either is occupied by rough and rotten trees, is nonstocked, or has inhibiting vegetation (table 4). Figures 7, 8, and 9 illustrate this situation. Even well-stocked stands have significant portions of their area occupied by inhibiting vegetation or rough and rotten trees (fig. 10).

Although there are few written records describing forest growth in the valley, various expeditions have noted the parklike conditions—a situation that continues to exist today. But it is difficult to piece together a complete picture of how these stands developed. A comment on tremendous areas of white spruce killed by insects in the 1930's may be a clue to the present low stocking of this species (Capps and Tuck 1933; Capps 1935). There are general comments of repeated fires occurring along the railroad and a large fire in the Matanuska Valley.[4] A major and continuing contribution to low stocking is that caused by competing grass and brush. Significant portions of the forest area are covered by a luxuriant growth of grass and thick sod. We observed little or

[4] Geo. L. Drake. Birch-spruce forests of the upper Cook Inlet region, Alaska. USDA Forest Serv. (in-Service report). 1920.

Table 4.–Stocking of commercial forest land by vegetation class, Susitna Valley, Alaska, 1965

Measure	Kind of occupancy				
	Desirable trees	Acceptable trees	Rough and rotten trees	Inhibiting vegetation and nonstocked	Total
Thousand acres	429	406	140	320	1,295
Percent	33.2	31.3	10.8	24.7	100.0

Figure 7.–Thousands of acres of open-stocked forest land occur at lower elevation. Hiline Lake at 600 feet.

Figure 8.–Tree growth indicates a commercial site although per-acre volumes are low and apparently will remain so. Hiline Lake.

Figure 9.—Close view of short limby trees characteristic of the open-grown type in figure 7.

Figure 10.—Cull birch 29 inches in diameter (below fork) in a well-stocked stand—Hewitt Lake.

no tree regeneration on these grassy sites. Stands of alder and willow brush also seem to inhibit tree vegetation although this inhibiting effect does not appear to be as consistent as grass. The inconsistency may be caused by the differing amounts of litter accumulation under the various species of alder and willow. The smothering effect of leaf litter observed by Gregory in his studies of spruce regeneration under birch may be part of the answer (Gregory 1966). Present and future silvicultural management plans should consider the problem of low stocking since it is apparently not new to the Susitna Valley stands.

Up to the present, hardwood logging in the Susitna Valley has been a highly selective operation with only the larger and better trees in a stand being harvested. The remaining smaller or lower quality trees are left standing; and since the ground remains essentially undisturbed, grasses and brush fill the openings. Regeneration is nearly nonexistent, and thus a cull stand is created. A forest management plan requiring clearcutting will probably be the only feasible harvesting practice that will insure adequate regeneration in this area, although selective cutting followed by a controlled burn may also be practical and would be more economical. Both of these methods have their drawbacks. Clearcutting, to be economically sound, awaits the establishment of integrated markets accepting the full harvest of the stand, such as veneer, lumber, and chips. The use of fire affects not only the forest but the entire ecological regime and will need considerable study before application in Alaska. Scarification, after clearcutting or selective cutting, is also a possibility when and if economic conditions permit.

Forest Types

Total commercial forest area and volume data are essential to the overall economic evaluation of an area. But to effectively plan the use of this resource, the land or resource manager also needs acreage, volume, and stand-size distribution by forest type.

Classification of forest type was based upon the species forming a plurality of the stocking. In the Susitna Valley, four forest types are recognized. In descending order of acreage they are: birch, spruce, cottonwood, and aspen—with the birch type preponderant and occupying nearly two-thirds of the commercial forest area (table 5).

Table 5.—Area of commercial forest land by forest type, Susitna Valley, Alaska, 1965

Measure	White spruce	Cottonwood	Aspen	Birch	Total
Thousand acres	334.2	120.4	18.4	822.0	1,295.0
Percent	25.8	9.3	1.4	63.5	100.0

Paper Birch Type Covers 822,000 Acres

Previous estimates of the wide extent of paper birch in the valley have proven to be correct.[5] Birch stands comprise 64 percent of the commercial forest acreage. Not only does the birch type predominate, but birch is also found in the most varied associations and sites. It occurs as pure stands as well as in mixtures with white spruce, aspen, and cottonwood (fig. 11). A black spruce-birch mixture is also found on many poorly drained areas. The better stands of birch and birch mixtures are located on the east side of the Susitna River, from Goose Bay near Anchorage to just north of Talkeetna. These are the well-known Talkeetna birch stands. Other notable stands are found west of Talkeetna along the Peters Creek road; between the Yentna hills and the Kahiltna River; the southwest slopes of the Yentna hills; around Hewitt Lake just south of the Yentna hills (figs. 11, 12); and on the flood plains at the mouth of the Skwentna River.

Growing-stock volume.—As a type, paper birch occupies two-thirds of the total commercial forest area with a volume of 794 million cubic feet or 55 percent of the total inventory volume of 1,436 million cubic feet.

Stand-size distribution is 64 percent sawtimber, 32 percent poletimber, and 4 percent seedlings and saplings. This is a picture of stands that are essentially near or past their rotational climax and should be shifting to the next ecological step -- white spruce (Lutz 1956). But this does not seem to be happening. The birch-spruce and spruce-birch mixtures appear to be at an arrested successional stage followed by a retrogressional opening-up process which possibly might be the ecological climax. These openings are filling in with grass and brush with virtually no tree regeneration.

Figure 11.—Aerial view of a good sawtimber stand at Hewitt Lake (400-foot elevation). Composition is: birch 50 percent; cottonwood 35 percent; spruce 15 percent. Medium to well stocked.

Figure 12.—A mixed sawtimber stand of birch and cottonwood at Hewitt Lake.

[5] See footnote 4, p. 8.

This open, parklike situation is probably created through the process of decay and the associated decline in tree vigor. The older and bigger trees with large amounts of decayed material in them continue to live and occupy growing space for long periods. A slowly decomposing litter layer builds up underneath where only brush and grass grow. When the tree finally dies, there are no replacements or necessary seedbed conditions for new regeneration. The results are large areas of poorly stocked sawtimber stands. And because of this low-stocking-low-volume situation they are not economical to harvest.

Board-foot volume.—Hardwood board-foot volume includes volume in trees of 11.0-inch d.b.h. and larger to a 9.0-inch top d.o.b. The total volume in the paper birch type is 1,768,376,000 board feet. This represents 44 percent of the total board-foot inventory as compared with the 55-percent proportion of cubic-foot volume.

Birch sawtimber stands, occupying 78 percent of the area in the type, average 2,800 board feet per acre (fig. 13). Overall, this is a realistic picture, but the better stands mentioned previously have higher volumes. One field plot has a measured net volume of 7,000 board feet per acre, and 5,000 board feet can be expected over extensive areas. Counterbalancing this are the many acres of understocked stands where 1,000 board feet per acre is common.

White Spruce Type Covers 334,000 Acres

Throughout most of interior Alaska, white spruce is dominant in stand composition. In the Susitna Valley, however, the type is in a minority position, occupying 26 percent of the area. The reasons for this are not clear. Possibly, it may be that fires have reduced the white spruce seed source or that the effects of the insect infestation noted in the 1930's are causing a retrogression in the normal succession to the climax white spruce type (Capps 1929, 1935; Capps and Tuck 1933). Considerable study is needed on the problems of regeneration if spruce is to be the preferred species for management.

There are few extensive stands of pure spruce (fig. 14). Spruce usually occurs as an overcanopy with birch (fig. 11). The better stands occur more frequently at slightly higher elevations—400 to 1,200

Figure 13.—Hewitt Lake birch sawtimber. Trees average 12-18 inches in d.b.h. and 60-70 feet in height.

Figure 14.—Pure stands of spruce are rare in the valley. Typically, spruce occurs in mixture with birch (fig. 11). Diameters are 9-16 inches, height 70-85 feet.

feet along the perimeter of the unit—whereas the better birch stands are located at elevations of less than 400 feet.

The spruce type occupies 334,200 acres. Seventy-seven percent of the stands are classed as sawtimber, only 19 percent as poletimber, none as seedling and sapling, and the remainder nonstocked. Although the data list no seedling and sapling stands in the spruce type, this is not a completely true picture. Although neither photo interpretation nor field checks recorded the presence of pure stands of spruce seedlings and saplings, a few stands were seen from the air but not confirmed by a ground visit. Apparently, the 200 ground plots randomly distributed over the 1.3 million acres of commercial forest land failed to sample this stratum.

Growing-stock volume.—As a species, white spruce contributes 454 million cubic feet or nearly one-third of the total inventory growing-stock volume. The spruce type, however, has but 290 million cubic feet or one-fifth of the total volume, probably because the spruce type occupies slightly more adverse sites than hardwoods and commonly occurs in less than majority volume with birch. Our field sample confirmed the former as only one field plot, classed as spruce type, occurred on a lowland site where the better growing sites and higher per-acre volumes are found.

The greater volume per acre in the birch type, 966 cubic feet as compared with 868 cubic feet for the spruce type, is also probably the result of site differences. There is a definite decrease in stand density with increasing elevation, with this decrease probably related to poorer drainage conditions. The soils at higher elevations are less well developed, and there are many areas of heavy, wet claylike soils.

By stand-size class, the cubic-foot growing-stock volume is distributed in this type as follows: sawtimber, 237 million feet; poletimber, 51 million feet; nonstocked, 2 million feet; and seedling and sapling stands, none.

Board-foot volume.—Softwood board-foot volume includes volume in trees 9.0-inch d.b.h. and larger to a 7.0-inch top d.o.b. Approximately one-fourth of the total inventory sawtimber volume is in the spruce type. Of this fourth, 92 percent is in sawtimber stands; 7 percent, in poletimber stands; and 2 percent, in nonstocked stands. Total volume in this type is 984 million board feet. Average volume per acre (heavily weighted by the Lake Beluga stands) is 2,945 board feet. Sawtimber stands average 3,513 board feet and poletimber 1,066 board feet per acre.

Because of their location in the higher elevation periphery of the valley, most of the spruce types must be considered inaccessible or, because of low per-acre volumes, inoperable. The hybrid Sitka spruce-white spruce stands below Beluga Lake and to the coast are an exception, carrying high per-acre volumes, and are easily accessible. Of eight field plots in that area, only one was below the average volume for the spruce type and one plot had a per-acre volume of nearly 15,000 board feet.

Cottonwood Type Covers 120,000 Acres

Two species of cottonwood are found in the valley. They are balsam poplar and black cottonwood. Concentrations of black cottonwood occur on the lower reaches of the Susitna River drainages grading into balsam poplar farther upstream and upland. We could not differentiate between these two species during the inventory, and throughout this report the name "cottonwood" is applied to both.

A primary invader, cottonwood is found on the moraines of the many glaciers feeding into the valley. These primary stands are generally of poor quality. The better stands are found on the islands and flood plains of the major rivers (fig. 15), although excellent stands also occupy upland sites (fig. 12).

Figure 15.—Cottonwood stands on the flood plains of the lower Susitna River; looking toward Cook Inlet.

Over 90 percent of the cottonwood stands are classed as sawtimber and the remainder as poletimber, with no record of seedling and sapling or nonstocked stands. Again, this is not an accurate picture because seedling and sapling stands were identified in the vicinity of other field plots, but our sample was not of a high enough intensity to sample this stratum.

Growing-stock volume.—Although occupying but 10 percent of the commercial forest area, the cottonwood type has nearly one-fourth of the total growing-stock volume. Nearly all of this volume, 321 million cubic feet out of 331 million, is in sawtimber stands. Perhaps more strikingly, cottonwood comprises 98.6 percent of all the inventory growing-stock volume of trees larger than a 21-inch d.b.h., and 89 percent of the volume of trees larger than a 17-inch d.b.h.

Volumes per acre averaged 2,753 cubic feet, compared with averages of 868 cubic feet for spruce, 966 for birch, and 1,124 for aspen. Sawtimber and poletimber stands averaged 2,929 cubic feet and 953 cubic feet per acre, respectively.

Board-foot volume.—Over 30 percent of the total sawtimber volume occurs in the cottonwood type. This volume totals 1,241 million board feet, of which 99.47 percent is in sawtimber stands.

Volumes per acre are comparatively high, averaging 10,307 board feet for all cottonwood stands. The highest gross volume recorded on a plot location was 34,000 board feet per acre.

At present, cottonwood stands represent the highest potential for economic development of the stands in the valley. They generally are close to the river system, have a high average volume, and may average 20-inch d.b.h. or more, with three or more 16-foot logs. (fig. 16). Some areas may produce even larger trees (fig. 17).

Figure 16.—Mature stand of cottonwood, 20-28-inch d.b.h., 100 feet in height. Heights to 140 feet have been noted in the area.

Figure 17.—Although diameters of 18-36 inches are common, greater sizes are reached, as evidenced by this 62-inch cottonwood in the foothills of the Alaska Range 100 miles from the mouth of the Susitna River.

Aspen Type Covers 18,400 Acres

The aspen type occupies a very minor 1.4-percent position in the total commercial forest land. The only aspen tallied was located in the Matanuska Valley, an area that has an extensive fire history. Elsewhere in the survey area, aspen occurs infrequently as a minority species.

Growing-stock volume.—The growing-stock volume in the aspen type is placed at 20,690,000 cubic feet, but the field sample failed to show the distribution of this volume. Our survey tables show all the volume to be in sawtimber stands, but many stands of aspen poles were also noted (fig. 18). The

Figure 18.—Aspen poles with a gradually encroaching spruce understory—probably an old burn in the Matanuska Valley.

volume of 2,249 cubic feet per acre shown for this type is based on but one field plot. In actuality, average volume of aspen stands probably would be little different from birch (966 cu. ft. per acre).

Quality

The effect of small-size trees shows markedly in log grade distributions. Although the Susitna Valley supports over 4 billion board feet of sawtimber, only 17 percent of this volume is in grade 2 or better logs (table 6). If the cottonwood volume were excluded, this percentage would drop to 5 percent.

Birch and cottonwood were graded according to "Hardwood Log Grades for Standard Lumber" (Forest Products Laboratory 1953). The specifications for these grades are correlated closely with the specifications for standard hardwood lumber grades. Grade 1 logs require a 13-inch and grade 2, an 11-inch inside-bark, small-end, scaling diameter. Only trees of 16- and 14-inch d.b.h. or larger, respectively, would meet these minimum diameter specifications. This is assuming roughly a 1-inch bark thickness and 2-inch taper in 16 feet. This eliminates 63 percent of the total volume from having grade 1 potential and 47 percent, from grade 2.

Birch

Alaska's paper birch, in particular that of the Susitna Valley, has been the object of numerous studies and cruises. Starting with a 1920 reconnaissance and continuing through cruises and recommendations by the Bureau of Land Management (BLM),

Table 6.–Net volume of sawtimber by species and quality class, Susitna Valley, Alaska, 1965

Log grade	White spruce	Birch	Cottonwood	Aspen	Total	
					Thousand board feet	Percent
	Thousand board feet					
1	--	15,984	177,262	--	193,246	4.78
2	32,726	146,210	321,333	--	500,269	12.34
3	1,605,446	826,026	729,560	19,043	3,180,075	78.44
4[1]	33,866	88,072	57,996	--	179,934	4.44
	1,672,038	1,076,292	1,286,151	19,043	4,053,524	100.00

[1] *Grade 4 logs are those below minimum standards for grade 3, but not cull.*

the reports have been of small, low-quality, defective trees (figs. 19, 20), chiefly usable as pulp with small amounts being suitable for veneer and furniture stock. Our inventory data confirm this. Estimates obtained from this inventory show only 1.5 percent of the birch volume qualifying as grade 1 logs (fig. 21); 13.6 percent, as grade 2; 76.7 percent, as grade 3; and the remainder as grade 4. For comparison, 42 percent of the Maine paper birch volume is in log grades 1 and 2 (Ferguson and Longwood 1960).

A recent lumber recovery study in the Susitna Valley (Hanks and Swanson 1967) made the following comparison with a similar Minnesota study:

> More No. 1 Common lumber was taken from all grades of the Alaska logs. The percentage yield of No. 1 Common and Better for log grades II and III was nearly equal for the two locations. For these same log grades, considerably more grade 3B lumber was present in the Alaska logs. This was, in part, because they contained more rot than those in the Minnesota study. However, it was noted that the Alaska logs exhibited less sweep.

Figure 19.—An overmature birch sawtimber-size tree. Except for evidence of decay this would qualify as a grade 1 saw log.

Figure 20.—A cross section of a birch sawtimber tree showing the extent of decay.

Spruce

Spruce was graded under "Official Grading Rules for Northern Hardwood and Softwood" (Northern Hemlock and Hardwood Manufacturers Association 1959). There were no logs qualifying as grade 1 (which required a 16-inch scaling diameter), only 2 percent as grade 2 (requiring a 12-inch scaling diameter), and the remainder qualified only for grades 3 and 4 (requiring an 8-inch scaling diameter). Most trees failed to have logs in the top two log grades because of small size, although limbiness also contributed heavily to degrade. Apparently this situation is not confined to Alaska, as the 1966 Minnesota survey report had nearly identical findings (Stone 1966).

Figure 21.—High quality birch logs from Matanuska Valley area. Scaling diameters are about 11-13 inches.

Cottonwood

Field estimates place 15 percent of the cottonwood volume in grade 1 logs, 25 percent, in grade 2 (fig. 22), and the remainder, in grades 3 and 4. The supply of grade 1 and 2 cottonwood logs totals 500 million board feet; and if this grade volume were uniformly distributed throughout the cottonwood type, there would be 4,000 board feet per acre in these two grades. Most of the cottonwood volume is close to rivers and could possibly be floated to a utilization point, but at present, no economically feasible market exists.

Data were also collected on lumber recovery from cottonwood (Hanks and Swanson 1967). Comparing the Susitna Valley cottonwood with eastern cottonwood, they concluded, "It is evident that the Alaska logs did not produce the amount of high grade lumber found in eastern cottonwood." However, the logs tested were balsam poplar, and it is possible that better recovery might be obtained from black cottonwood.

Figure 22.—Grades 1 and 2 cottonwood logs at a small sawmill in the Matanuska Valley.

Growth

Net annual growth in the Susitna Valley totals 32,265,000 cubic feet or 122,636,000 board feet. Expressed as a percent of net growing-stock volume, this is equivalent to 2.25 percent for cubic volume and 3.03 percent for board-foot volume.

Growth rates vary little by species. Cubic-foot growth rates for spruce and birch are nearly identical, aspen a little higher, and cottonwood considerably lower. Board-foot growth rates follow a similar pattern.

Growth potential in the valley is considerably better than is indicated above; but low stocking, cull, and overage trees tend to lower this potential and offer possibilities for improved management. A growth rate of 3 to 4 percent is not beyond reason if the area occupied by cull trees (11 percent) and inhibiting vegetation (24 percent) can be reduced. Even with the present stand structure, the present rate of growth in the valley compares favorably with the 3.2 percent reported in 1965 for the Lake States (USDA Forest Service 1965).

The above discussion of growth applies to commercial stands. Tree growth, however, is not restricted to just those stands. Calculations of actual plot growth, as opposed to predicted growth, indicate that half of our ground plot sample in the subcommercial strata are now producing at a commercial level of more than 20 cubic feet per acre per year.

We have analyzed the growth characteristics of the commercial and subcommercial strata to see the reasons for this disparity. One apparent difference is that trees on sites we have classed as subcommercial are substantially shorter than those on commercial sites. Since we classify on a height-age relationship (Gregory and Haack 1965; Horton and Lees 1961), this explains why these stands were classed subcommercial. The high growth rate can be explained by the diameter growth (without corresponding height growth) on significantly more trees per acre than are found on commercial sites. However, these noncommercial stands are not capable of sustaining a 20-cubic foot MAI to their rotation age.

It appears that nearly one-half of the 584,000 acres of subcommercial strata have potential for pulp production. The average plot volume of the better field plots in this stratum is 1,410 cubic feet per acre, although board-foot volumes are not nearly so favorable. Perhaps these stands should be considered commercial or merchantable and included in the allowable cut computations for the valley.

Volume Loss–Defect

For this inventory we used defect factors from a cull study made for an earlier inventory.[6] These factors for all live commercial trees are listed below (table 7).

The same factors were used for cottonwood as for birch since the 1957 study had insufficient data for cottonwood.

Common decay organisms causing extensive damage include *Fomes igniarius* and *F. applanatus* in birch, aspen, and cottonwood; *Polyporus resinosus* in birch; and *F. pini, Chrysomyxa ledicola,* and *Peridermium coloradense* in spruce (Kimmey and Stevenson 1957).

The importance of rough and decayed trees in the overall picture can be seen by a comparison of the net and gross volume totals in appendix tables 17 and 27. The total volume reduction due to cull is 16 percent or 271 million cubic feet. By species, there is a 25.3 percent loss in birch, 24.5 percent in aspen, 8.7 percent in cottonwood, and 5.2 percent in spruce. When this is converted to board feet, the unmerchantable volume amounts to about 1 billion board feet–an average of 800 board feet in cull volume on every acre of commercial forest land.

Volume Loss–Mortality

To measure mortality, we had to estimate how long a tree had been dead. This determination was both subjective and variable, and we suspect the mortality volume estimate may be low. Future remeasurements should improve upon our present estimates.

The estimated annual growing-stock volume loss by mortality amounts to 2,464,000 cubic feet. This is 0.6 percent of the net growing-stock volume and about one-third that reported for similar areas (USDA Forest Service 1965). Loss of sawtimber volume totals 9,635,000 board feet. The 4:1 ratio of board feet to cubic feet seems to confirm a higher rate of loss in larger trees since the ratio for total inventory volume is only 3:1.

A theory that may partially account for the low mortality estimate concerns the growth characteristics of birch. Although this species has a pathological rotation of 80-100 years, these trees do not die suddenly. A few leaves are enough to keep these trees in the live category indefinitely. When death does occur, it is very difficult to determine whether the tree died last year or 10 years ago. Our mortality estimates are for trees dying within the past 5 years, and we are not sure we are accurately estimating that interval.

In most cases, cause of death was not specifically identifiable, but age, disease, and weather are believed to be major factors. There is evidence of extensive old burns along the railroad and in several other areas, though in the past decade fire has not been important as a cause of mortality. We did not see any signs of insect damage on any species, although an outbreak of spruce budworm was observed in an adjacent area in 1962. Needle rust was noted on many trees but did not appear to be causing any appreciable damage to the tree. This fungus must reoccur several years in succession to damage or kill a tree (Kimmey and Stevenson 1957).

Table 7.–Volume reduction for defect by species and kind of volume, Susitna Valley, Alaska, 1965

Kind of volume	Birch	Spruce	Cottonwood	Aspen
	Percent defect			
Cubic-foot volume	3	2	3	8
Board-foot volume	25	11	25	40

[6] Dave W. French. Tree measurement and cull factors for the interior of Alaska. 1957. (Unpublished report on file at the Institute of Northern Forestry, Juneau.)

Allowable Cut

An allowable annual cut of 25 million cubic feet (73 million board feet) would be possible for the Susitna Valley if all commercial forest land were economically accessible and committed to timber production. However, in this study no attempt was made to classify the land by accessibility or ultimate use. One economist (Massie 1966) has estimated an allowable cut of 22 million board feet on 200,000 acres, defining accessible land as that within 20 miles of a usable road or railroad. To this might be added a considerable volume accessible by water. This accessible volume is mostly birch and cottonwood.

The total allowable cut was calculated by use of Kemp's formula. This employs an average rotation age for all species and acres by stand-size class. The formula is:

$$\text{Annual cut} = \frac{7A + 5A_1 + 3A_2 + A_3}{4R} \times (MA)$$

where: A = area of sawtimber stands
A_1 = area of poletimber stands
A_2 = area of seedling/sapling stands
A_3 = area of nonstocked stands
R = average rotation age (100 years)
MA = average volume per acre in sawtimber stands

The value obtained compares closely with that obtained by use of Von Mantel's formula applied by species:

where:

$$\text{Annual cut} = \frac{\text{growing-stock volume}}{1/2 \text{ rotation age}}$$

Allowable cut by species would be:

Birch and aspen = 16,530,000 cubic feet (80-year rotation)
Spruce = 7,510,000 cubic feet (120-year rotation)
Cottonwood = 7,020,000 cubic feet (100-year rotation)

Although a program of accelerated cutting, essentially a sanitation cut, would be desirable from a management viewpoint, the present lack of markets dictates a low level of partial cutting from only the best stands. Under this handicap, managing for the future may be an impossible task.

AREA USE

Forest Products

Past utilization of the timber resources in the valley has been light and sporadic. Logs for cabins and pit props during the mining activities of the early 1900's were the first noted commercial use. A peak in use probably was attained in 1915-20 during the construction and early operation of the Alaska Railroad.

Small sawmills have operated at various times. One of the first recorded was at Eklutna in 1916.[7] Similar operations have continued to now. The largest operation, the Alaska Hardwoods Co. at Wasilla, operated for a few years but closed for economic reasons and has not reopened. Timber cutting in the valley, except for land clearing and domestic fuel, is at a low ebb. Present production is limited to local needs for lumber, house logs, and a few industrial uses (figs. 23, 24, 25, 26). A mill to draw timber from the area served by the railroad is being considered for the Seward area. This operation, possibly coupled with a speciality sawmill and a veneer mill, may aid in the managed utilization of the valley's forest resource. However, this mill is primarily softwood-oriented, and most of the volume in the Susitna Valley is hardwood.

Many factors have, to date, hindered the profitable use of the valley's timber. Lack of markets, small size and low quality of the preferred species, low volume per acre of high-quality material, lack of economical logging and milling operations, and a wet, soggy terrain all contribute. Adaptation of methods used elsewhere in like conditions and the development of an integrated sawmill, veneer mill, and chipping plant operation supplying a pulpmill may be a partial solution. Developing and nurturing a local market is also part of the solution—particularly since lumber products sent to Alaska are subject to high shipping rates. This should give an Alaskan producer some price advantage.

Adaptations and innovations to reduce logging costs are also needed. The timber is small and consequently can be handled by the new highly mechanical log-harvesting equipment; but above all, experienced loggers are needed.

[7] See footnote 4, p. 8.

Figure 23.—An example of industrial use; pallets cut from small-diameter spruce.

Figure 24.—A small two-bedroom home constructed from locally sawn white spruce.

Figure 25.—House logs and lumber cut from cottonwood growing in the Matanuska Valley.

Agricultural Uses

Estimates of arable land in the Susitna Valley range as high as 1.3 million acres (Bennett and Rice 1915). Balanced against other economic uses of the land, this acreage will probably never be attained. At present, about 10,000 acres are being used for agricultural purposes, most of this in the Matanuska Valley (Kellogg and Nygaard 1951). Extensive homestead clearings are found along the roads in the valley, but these are not presently in agricultural production.

The majority of the timber cut in clearing operations is windrowed and burned—very little enters any commercial market. An integrated mill with an outlet for chips could provide a market for much of this presently unutilized resource.

Recreation

Promotion of summer-homesite sales and leases by the State of Alaska has expanded recreational use to lands previously used only for timber. A large number of the choice lake sites in the vicinity of Anchorage are being developed for recreation and summer homes, as are a number of more distant lake sites accessible only by air (fig. 27). Most of these sites will probably remain untouched by any timber harvesting activities and continue as recreational areas.

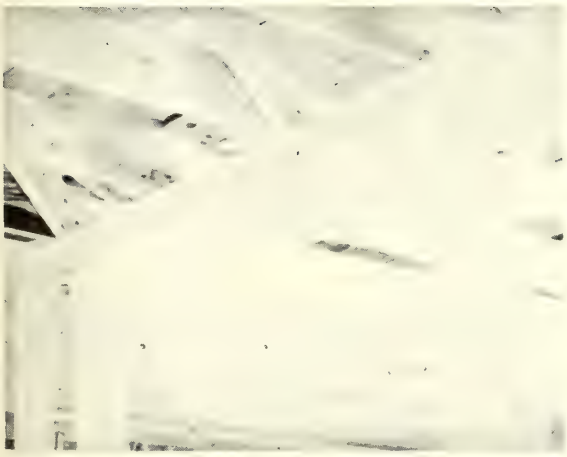

Figure 26.—Interior of house in figure 24. Many knots are evident but do not prevent use as construction lumber.

Figure 27.—Hiline Lake typifies the areas set aside by the State for summer homesites.

A large number of moose are found in the valley and Dall sheep, mountain goats, and black and grizzly bear are in the foothills and mountains. King, red, silver, and pink salmon all ascend the Susitna River and its tributaries to spawn. These, along with Dolly Varden and the cutthroat and rainbow trout, provide recreational outlets for the hunter, the fisherman, and the photographer. Picture all of this against the backdrop of glaciers and snowcapped mountains topped by Mount McKinley (fig. 28). It is not at all unlikely that income from recreation activities, both direct and esthetic, will continue to surpass timber product values.

Figure 28.—Some of the scenery awaiting the photographer. Mount McKinley with the Kahiltna glacier in the foreground.

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Appendix

FOREST SURVEY METHODS

The estimates of area breakdowns and timber volumes are based on a double sampling procedure (Bickford 1952). Enough points to satisfy specific levels of statistical precision were distributed uniformly on aerial photographs. These points were classified on photos by land and forest types. A subsample was drawn from all land classes and reexamined. Those originally classed as commercial forest land were visited on the ground as well as any points that upon reexamination were questionably classified.

Two hundred plots were visited on the ground and classed as commercial (CFL), subcommercial, noncommercial (NCFL), or nonforest (NF). Complete information was obtained on species, stand composition, tree measurement, growth, and mortality, and each tree was classified for management purposes by use of guides set forth in the Forest Survey Handbook.

These data were machine processed to obtain the various area and volume data needed or specified.

Area was obtained by a dot count on 1:63,360 topographic maps. Photo coverage was provided by the State Division of Lands, the U.S. Bureau of Land Management, and the U.S. Soil Conservation Service.

SAMPLING ERROR

The reliability of the inventory is expressed in terms of relative sampling errors.

		Sampling error achieved
Area	CFL, per million acres	0.07
	NCFL, per million acres	.05
Volume	CFL, per billion cubic feet	.10
	CFL, growth per billion cubic feet	.10

For the Susitna Valley, we are reporting 1,435,935,000 cubic feet of growing-stock volume. If repeated samples were taken of this population, the chances are two times in three that this sample is one of the samples for which the true value is contained within the sample confidence interval.

The Susitna Valley inventory did not meet the specified accuracy standards. The initial field sample failed to allow for the unexpected changes in photo classification and resulted in sampling errors higher than specified in the Forest Survey Handbook. In view of the current level of timber utilization in the valley, the supplemental fieldwork needed to reduce the error would have been too costly in time and money.

PRINCIPAL TREE SPECIES

Softwoods:	
White spruce	*Picea glauca* (Moench) Voss
Black spruce	*Picea mariana* (Mill.) B.S.P.
Hardwoods:	
Paper birch	*Betula papyrifera* Marsh.
Black cottonwood	*Populus trichocarpa* Torr. & Gray
Balsam poplar	*Populus balsamifera* L.
Quaking aspen	*Populus tremuloides* Michx.

TERMINOLOGY

Allowable cut.—The volume of timber that would be cut on commercial forest land during a given period under specified management plans for sustained production such as those in effect on National Forests.

Area condition.—The commercial forest area was segregated into six condition classes based on the following definitions:

Class 10.—Areas 100 percent or more stocked with desirable trees and not overstocked. Stands in this category generally do not require any treatment at present to maintain high level of growth.

Class 20.—Areas 100 percent or more stocked with desirable trees and overstocked. Stands in this category need a treatment such as thinning to produce maximum levels of growth of desirable trees.

Class 30.—Areas 60 to 100 percent stocked with desirable trees, and with less than 30 percent of the area controlled by acceptable growing-stock trees, cull trees, inhibiting vegetation slash, or nonstockable conditions. Stands in this category generally have conditions favorable for natural improvement of stocking without special treatment.

Class 40.—Areas 60 to 100 percent stocked with desirable trees and with 30 percent or more of

the area controlled by other trees (or overstocked areas) and/or conditions that ordinarily prevent occupancy by desirable trees. Stands in this category generally have little prospect for improvement in desirable tree stocking without special treatment such as thinning, cull tree removal, etc.

Class 50.—Areas less than 60 percent stocked with desirable trees, but with 100-percent or more stocking with growing stock trees. Stands in this category generally have little prospect for improved desirable tree stocking without special treatment. Stands almost to rotation age would usually not be treated.

Class 60.—Areas less than 60 percent stocked with desirable trees, but with 60- to 100-percent stocking with growing-stock trees. Stands in this category generally have little prospect for improved desirable tree stocking without special treatment such as timber stand improvement or planting.

Cull trees.—Live trees of sawtimber or poletimber size that are unmerchantable for saw logs now or prospectively because of defect, rot, or species.

Rough trees.—Live trees of 5.0-inch and larger d.b.h. that do not contain a saw log now or prospectively primarily because of roughness, poor form, or noncommercial species.

Rotten trees.—Live trees of 5.0-inch and larger d.b.h. that do not contain a saw log now or prospectively primarily because of rot.

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover, and not currently developed for nonforest use.

Commercial forest land.—Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying as commercial forest land have the capability of producing in excess of 20 cubic feet per acre per year of industrial wood under management.)

Noncommercial forest land.—Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions (producing less than 20 cubic feet per acre per year) and productive forest land withdrawn from commercial timber use through statute or administrative regulation. This classification includes *subcommercial forest land* producing between 15 and 20 cubic feet per acre per year.

Forest types.—A classification of forest land based upon the species forming a plurality of the live tree stocking.

Spruce.—Forests in which a plurality of the stand is white spruce. Common associates include birch, aspen, and cottonwood.

Cottonwood.—Forests in which a plurality of the stand is black cottonwood and/or balsam poplar. Common associates include white spruce and birch.

Aspen or birch.—Forests in which a plurality of the stand is aspen and paper birch, singly or in combination. Common associates include black cottonwood and white spruce.

Growing-stock trees.—Sawtimber trees, poletimber trees, saplings, and seedlings; that is, all live trees except cull trees.

Desirable trees.—Growing-stock trees having no serious defects in quality limiting present or prospective use, relatively high vigor, and containing no pathogens that may result in death or serious deterioration before rotation age. They include the type of trees forest managers aim to grow; that is, the trees left in silvicultural cutting or favored in cultural operations.

Acceptable trees.—Trees meeting the specifications for growing stock but not qualifying as desirable trees.

Inhibiting vegetation.—Cover sufficiently dense to prevent establishment of tree seedlings.

International 1/4-inch rule.—A rule used to determine the log volume in board feet (Bruce and Schumacher 1950).

Mean annual increment (MAI).—A measure of the volume of wood, in terms of cubic feet, produced on 1 acre during 1 year. Forest Survey minimum standard for commercial forest land is 20 cubic feet per acre per year.

Mortality.—Number or sound-wood volume of live trees dying from natural causes during a specified period (5 years).

Net annual growth of growing stock.—The annual change in volume of sound wood in live sawtimber and poletimber trees during a specified period.

Net annual growth of sawtimber.—The annual change in net board-foot volume of live sawtimber trees during a specified period.

Net volume.—The gross volume of a tree less deductions for rot, sweep, or other defect affecting product use.

Volume of timber.—The volume of sound wood in the bole of growing-stock, cull, and salvable dead trees 5.0 inches and larger in diameter at breast height, from stump to a minimum 4.0-inch top outside bark or to the point where the central stem breaks into limbs.

Nonforest land.—Land that does not qualify as forest land. Includes land that has never supported forests and lands formerly forested where forest use is precluded by development for nonforest uses, such as crops, improved pasture, residential areas, and city parks. Also includes improved roads and certain areas of water classified by the Bureau of the Census as land. Unimproved roads, streams, canals, and nonforest strips in forest areas must be more than 120 feet wide, and clearings in forest areas must be more than 1 acre in size, to qualify as nonforest land.

Salvable dead trees.—Standing dead trees that are considered currently or potentially merchantable by regional standards. A poletimber tree must be more than one-half sound; a sawtimber tree more than one-third sound (board measure).

Site classes.—A classification of forest land in terms of inherent capacity to grow crops of industrial wood.

Stocking.—The degree of occupancy of land by trees, measured by basal area and/or the number of trees in a stand by size or age and spacing, compared to the basal area and/or number of trees required to fully utilize the growth potential of the land; that is, the stocking standard.

Overstocked areas.—Areas where growth of trees is significantly reduced by excessive numbers of trees.

Nonstocked areas.—Commercial forest lands less than 16.7 percent stocked with growing-stock trees.

Stand-size classes.—A classification of forest land based on the size class of the growing stock present; that is, sawtimber, poletimber, or saplings and seedlings.

Tree-size classes.—A classification based on the diameter of the tree at breast height (4-1/2 feet above the ground on the uphill side of the tree):

Sawtimber-size tree:

Softwood. A tree of 9.0-inch d.b.h. and larger.

Hardwood. A tree of 11.0-inch d.b.h. and larger.

Poletimber-size tree:

Softwood. A tree of 5.0- to 8.9-inch d.b.h.

Hardwood. A tree of 5.0- to 10.9-inch d.b.h.

Sapling-size tree. A tree of 1.0- to 4.9-inch d.b.h.

Seedling-size tree. A tree of less than 1.0-inch d.b.h.

EXPANDED DESCRIPTION OF SOILS MAP AREAS

Area 1.[8] Dominantly Entisols (Bodenburg, Doone, Knik, Susitna). Shallow to moderately deep silty soils. Principal trees are white spruce, paper birch, and quaking aspen. Balsam poplar occurs on flood plains (Susitna series).

Area 2. Weakly developed very shallow to shallow Spodosols (Homestead), Aquepts (Jacobsen, Coal Creek), and Histosols (Salamatof). Principal trees on the Spodosols are white spruce, paper birch, and quaking aspen. On the Aquepts they are black spruce and paper birch. The muskegs (Histosols) are largely treeless, but in places are covered by black spruce.

Area 3. Fairly well-developed Spodosols (Flat Horn, Kashwitna, Nancy) in moderately deep to deep loess on uplands, Entisols (Susitna) on flood plains, Aquepts, and Histosols (Salamatof). Principal trees are white spruce and paper birch on the uplands; spruce, birch, and balsam poplar on the flood plains; and black spruce on poorly drained soils. Note that Spodosols here and in area 4 are bisequal, indicating two major periods of silt deposition.

Area 4. Strongly developed Spodosols (Chulitna, Rabideux) in moderately deep to deep loess on uplands, Entisols (Susitna) on flood plains, and Histosols (Salamatof). Trees are similar to those in area 3. The Histosols are very extensive, making up about 40 percent of the area.

Area 5. Spodosols (Talkeetna) in shallow silty materials immediately above tree line, and very thin Spodosols (no series) in alpine areas. The vegetation on the Spodosols is mostly grasses, forbs, willows, and alder. Alpine tundra covers the higher areas.

Area 6. Aquepts or Aquic Psamments in glacial outflow materials (no series). Largely covered by willows, other shrubs, grasses, and sedges.

Area 7. Rough mountainous land and glaciers.

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[8] Numbers refer to soil association areas on soils map (fig. 2).

TABLES

These data have been compiled for forest land producing 20 cubic feet or more per acre per year. Data tables for forest land producing 15 cubic feet or more annually are available upon request.

Volume data herein is for cubic feet or board feet International 1/4-inch scale. Table 28 lists Scribner rule conversion factors by species and 2-inch diameter classes.

Some common metric conversions that can be applied are:

1 cubic meter per hectare	=	14.3 cubic feet per acre
1 cubic foot per acre	=	0.06997 cubic meter per hectare
1 cubic meter per hectare	=	35.3145 cubic feet
1 cubic foot	=	0.0283 cubic meter
1 hectare	=	2.47 acres
1 acre	=	0.4047 hectare

Table 8.–Area by land classes, Susitna Valley, Alaska, 1965

(In thousand acres)

Land class	Area
Forest land:	
Commercial (over 20 MAI[1])	1,295
Subcommercial (15-20 MAI)	584
Noncommercial (under 15 MAI)	1,322
Total	3,201
Nonforest land	2,165[2]
Total land area	5,366[3]

[1] *MAI–mean annual increment in cubic feet per acre.*

[2] *Includes 91,000 acres defined as water by Forest Survey, but as land by the Bureau of Census.*

[3] *Total gross area of the unit, adding 244,000 acres of water bodies of more than 40 acres and over 1/8-mile-wide streams classified by the Bureau of Census as water, is 5,610,000 acres.*

Table 9.–Area of commercial forest land by forest type and stand-size class, Susitna Valley, Alaska, 1965

(In thousand acres)

Forest type	Sawtimber stands	Poletimber stands	Seedling-sapling stands	Nonstocked areas	Total	Percent
White spruce	258.8	63.2	–	12.2	334.2	25.8
Balsam poplar	109.7	10.7		–	120.4	9.3
Quaking aspen	9.2	–	9.2	–	18.4	1.4
Paper birch	490.7	210.4	120.9	–	822.0	63.5
Total	868.4	284.3	130.1	12.2	1,295.0	100.0
Percent	67.0	22.0	10.0	1.0	100.0	

Table 10.–Area of commercial forest land by area condition and occupancy class, Susitna Valley, Alaska, 1965

(In thousand acres)

Area condition class	Growing stock		Rough and cull trees	Inhibiting vegetation	Nonstocked	Nonstockable	Total	Percent
	Desirable	Acceptable						
10	181.4	108.0	21.2	24.7	4.6	2.6	342.5	26.4
20	2.2	3.9	1.0	–	.8	–	7.9	.6
30	140.0	128.1	46.9	43.4	2.3	–	360.7	27.9
40	26.8	57.9	21.1	30.8	–	–	136.6	10.5
50	46.5	64.9	20.6	78.0	.8	–	210.8	16.3
60	32.6	43.1	29.2	127.5	4.1	–	236.5	18.3
Total	429.5	405.9	140.0	304.4	12.6	2.6	1,295.0	100.0
Percent	33.2	31.3	10.8	23.5	1.0	.2	100.0	

Table 11.–Area of commercial forest land by forest type and site class, Susitna Valley, Alaska, 1965

(In thousand acres)

Forest type	Site class[1]		Total	Percent
	20 to 50	50 to 85		
White spruce	334.2	–	334.2	25.8
Cottonwood	78.8	41.6	120.4	9.3
Quaking aspen	18.4	–	18.4	1.4
Paper birch	822.0	–	822.0	63.5
Total	1,253.4	41.6	1,295.0	100.0
Percent	96.8	3.2	100.0	

[1] *Mean annual increment per acre in cubic feet.*

Table 12.–Number of growing-stock trees on commercial forest land by diameter class and species, Susitna Valley, Alaska, 1965

(In thousand trees)

Diameter class[1]	Softwoods			Hardwoods				All species	Percent
	White spruce	Black spruce	Total	Paper birch	Cottonwood	Quaking aspen	Total		
1.0-2.9	27,008	23,892	50,900	72,450	2,501	3,613	78,564	129,464	36.6
3.0-4.9	16,841	5,560	22,401	51,995	3,078	3,726	58,799	81,200	22.9
5.0-6.9	17,887	1,450	19,337	21,914	2,530	2,006	26,450	45,787	12.9
7.0-8.9	15,917	230	16,147	16,833	2,711	746	20,290	36,437	10.3
9.0-10.9	13,291	–	13,291	14,015	1,140	553	15,708	28,999	8.2
11.0-12.9	4,566	–	4,566	9,054	1,147	356	10,557	15,123	4.3
13.0-14.9	2,456	–	2,456	5,087	1,100	47	6,234	8,690	2.5
15.0-16.9	1,474	–	1,474	1,580	724	–	2,304	3,778	1.1
17.0-18.9	302	–	302	456	512	–	968	1,270	.4
19.0-20.9	125	–	125	162	780	–	942	1,067	.3
21.0-22.9	–	–	–	42	507	–	549	549	.2
23.0-24.9	–	–	–	–	305	–	305	305	.1
25.0-26.9	–	–	–	–	263	–	263	263	.1
27.0-28.9	–	–	–	–	251	–	251	251	.1
29.0-30.9	–	–	–	–	124	–	124	124	(2)
31.0-32.9	–	–	–	–	122	–	122	122	(2)
33.0-34.9	–	–	–	–	53	–	53	53	(2)
35.0-36.9	–	–	–	–	–	–	–	–	–
37.0-38.9	–	–	–	–	25	–	25	25	(2)
39.0-40.9	–	–	–	–	15	–	15	15	(2)
41.0 and larger	–	–	–	–	9	–	9	9	(2)
Total	99,867	31,132	130,999	193,588	17,897	11,047	222,532	353,531	100.0
Percent	28.2	8.8	37.0	54.8	5.1	3.1	63.0	100.0	

[1] *Inches at breast height.*

[2] *Less than 0.1 percent.*

Table 13.–Net volume of timber on commercial forest land by class of timber and by softwoods and hardwoods, Susitna Valley, Alaska, 1965

(In thousand cubic feet)

Class of timber	Softwoods	Hardwoods	All species	Percent
Sawtimber trees:				
Saw-log portion	284,886	617,148	902,034	60.4
Upper-stem portion	46,377	36,168	82,545	5.5
Total	331,263	653,316	984,579	65.9
Poletimber trees	122,524	328,832	451,356	30.2
All growing-stock trees	453,787	982,148	1,435,935	96.1
Rough trees	315	10,835	11,150	.8
Rotten trees	841	41,482	42,323	2.8
Salvable dead trees	2,036	2,225	4,261	.3
Total, all timber	456,979	1,036,690	1,493,669	100.0
Percent	30.6	69.4	100.0	

Table 14.–Net volume of growing stock on commercial forest land by stand-size class and forest type, Susitna Valley, Alaska, 1965

(In thousand cubic feet)

Stand-size class	White spruce	Cottonwood	Quaking aspen	Paper birch	Total	Percent
Sawtimber	237,393	321,262	20,690	507,767	1,087,112	75.7
Poletimber	51,043	10,200	–	252,798	314,041	21.9
Seedlings and saplings		–	–	33,183	33,183	2.3
Nonstocked	1,599	–	–	–	1,599	.1
All classes	290,035	331,462	20,690	793,748	1,435,935	100.0
Percent	20.2	23.1	1.4	55.3	100.0	

Table 15.–Net volume of sawtimber on commercial forest land by stand-size class and forest type, Susitna Valley, Alaska, 1965

(In thousand board feet)[1]

Stand-size class	White spruce	Cottonwood	Quaking aspen	Paper birch	Total	Percent
Sawtimber	909,067	1,234,439	59,899	1,373,271	3,576,676	88.2
Poletimber	67,341	6,546	-	362,700	436,587	10.8
Seedlings and saplings	–	–	–	32,405	32,405	.8
Nonstocked	7,856	–	–	–	7,856	.2
All classes	984,264	1,240,985	59,899	1,768,376	4,053,524	100.0
Percent	24.3	30.6	1.5	43.6	100.0	

[1]*International 1/4-inch scale.*

Table 16.–Net volume of sawtimber on commercial forest land by forest type and volume class, Susitna Valley, Alaska, 1965

(In thousand board feet)[1]

Forest type	Stand volume per acre (board feet)			All classes	Percent
	Below 1,500	1,500–5,000	Over 5,000		
White spruce	75,870	566,038	342,356	984,264	24.3
Cottonwood	22,098	65,679	1,153,209	1,240,986	30.6
Quaking aspen	–	–	59,899	59,899	1.5
Paper birch	89,751	1,156,207	522,417	1,768,375	43.6
All types	187,719	1,787,924	2,077,881	4,053,524	100.0
Percent	4.6	44.1	51.3	100.0	

[1]*International 1/4-inch scale.*

Table 17.–Net volume of growing stock on commercial forest land by diameter class and species, Susitna Valley, Alaska, 1965

(In thousand cubic feet)

Diameter class[1]	Softwoods			Hardwoods				All species	Percent
	White spruce	Black spruce	Total	Paper birch	Cottonwood	Quaking aspen	Total		
5.0-6.9	39,315	2,565	41,880	51,222	4,864	4,055	60,141	102,021	7.1
7.0-8.9	80,013	631	80,644	90,294	15,514	4,516	110,324	190,968	13.3
9.0-10.9	131,022	–	131,022	139,535	13,370	5,461	158,366	289,388	20.2
11.0-12.9	74,278	–	74,278	141,258	17,170	6,000	164,428	238,706	16.6
13.0-14.9	57,119	–	57,119	113,613	29,235	1,071	143,919	201,038	14.0
15.0-16.9	49,190	–	49,190	46,430	26,141	–	72,571	121,761	8.5
17.0-18.9	13,482	–	13,482	17,637	22,971	–	40,608	54,090	3.8
19.0-20.9	6,172	–	6,172	7,581	47,700	–	55,281	61,453	4.3
21.0-22.9	–	–	–	2,496	37,452	–	39,948	39,948	2.8
23.0-24.9	–	–	–	–	24,839	–	24,839	24,839	1.7
25.0-26.9	–	–	–	–	26,810	–	26,810	26,810	1.8
27.0-28.9	–	–	–	–	27,237	–	27,237	27,237	1.9
29.0-30.9	–	–	–	–	16,421	–	16,421	16,421	1.1
31.0-32.9	–	–	–	–	18,621	–	18,621	18,621	1.3
33.0-34.9	–	–	–	–	9,598	–	9,598	9,598	.7
35.0-36.9	–	–	–	–	–	–	–	–	–
37.0-38.9	–	–	–	–	5,905	–	5,905	5,905	.4
39.0-40.9	–	–	–	–	3,967	–	3,967	3,967	.3
41.0 and larger	–	–	–	–	3,164	–	3,164	3,164	.2
Total	450,591	3,196	453,787	610,066	350,979	21,103	982,148	1,435,935	100.0
Percent	31.4	0.2	31.6	42.5	24.4	1.5	68.4	100.0	

[1] *Inches at breast height.*

Table 18.–Net volume of sawtimber on commercial forest land by diameter class and species, Susitna Valley, Alaska, 1965

(In thousand board feet)[1]

Diameter class[2]	Softwoods			Hardwoods				All species	Percent
	White spruce	Black spruce	Total	Paper birch	Cottonwood	Quaking aspen	Total		
9.0-10.9	685,933	–	685,933					685,933	16.9
11.0-12.9	371,159	–	371,159	425,191	42,489	15,955	483,635	854,794	21.1
13.0-14.9	282,125	–	282,125	382,059	100,345	3,088	485,492	767,617	18.9
15.0-16.9	239,384		239,384	165,234	98,263	–	263,497	502,881	12.4
17.0-18.9	65,260	–	65,260	65,397	90,436	–	155,833	221,093	5.5
19.0-20.9	28,177		28,177	28,745	197,110		225,855	254,032	6.3
21.0-22.9	–	–	–	9,666	158,217		167,883	167,883	4.1
23.0-24.9	–				105,966	–	105,966	105,966	2.6
25.0-26.9	–	–	–	–	116,550		116,550	116,550	2.9
27.0-28.9	–		–	–	118,938	–	118,938	118,938	2.9
29.0-30.9	–	–	–	–	72,596		72,596	72,596	1.8
31.0-32.9	–	–		–	82,941	–	82,941	82,941	2.0
33.0-34.9	–	–	–	–	43,063		43,063	43,063	1.1
35.0-36.9	–	–	–	–		–	–	–	–
37.0-38.9	–	–		–	26,741	–	26,741	26,741	.7
39.0-40.9	–	–		–	18,028	–	18,028	18,028	.4
41.0 and larger		–	–		14,468		14,468	14,468	.4
Total	1,672,038	–	1,672,038	1,076,292	1,286,151	19,043	2,381,486	4,053,524	100.0
Percent	41.2	–	41.2	26.6	31.7	0.5	58.8	100.0	

[1] *International 1/4-inch scale.*

[2] *Inches at breast height.*

Table 19.–Net volume of sawtimber on commercial forest land by species and quality class, Susitna Valley, Alaska, 1965

(In thousand board feet)[1]

Species	Grade 1	Grade 2	Grade 3	Grade 4	Total	Percent
Softwoods:						
White spruce	–	32,726	1,605,446	33,866	1,672,038	41.2
Black spruce	–	–	–	–	–	–
Total	–	32,726	1,605,446	33,866	1,672,038	41.2
Hardwoods:						
Paper birch	15,984	146,210	826,026	88,072	1,076,292	26.6
Cottonwood	177,262	321,333	729,560	57,996	1,286,151	31.7
Quaking aspen	–	–	19,043	–	19,043	.5
Total	193,246	467,543	1,574,629	146,068	2,381,486	58.8
All species	193,246	500,269	3,180,075	179,934	4,053,524	100.0
Percent	4.8	12.3	78.5	4.4	100.0	

[1] *International 1/4-inch scale.*

Table 20.–Gross annual growth of growing stock on commercial forest land by species and forest type, Susitna Valley, Alaska, 1965

(In thousand cubic feet)

Species	White spruce	Cottonwood	Quaking aspen	Paper birch	Total	Percent
Softwoods:						
White spruce	4,845	449	143	4,870	10,307	31.9
Black spruce	61	–	–	250	311	1.0
Total	4,906	449	143	5,120	10,618	32.9
Hardwoods:						
Paper birch	1,290	21	89	13,037	14,437	44.8
Cottonwood	83	5,487	44	973	6,587	20.4
Quaking aspen	–	–	164	459	623	1.9
Total	1,373	5,508	297	14,469	21,647	67.1
All species	6,279	5,957	440	19,589	32,265	100.0
Percent	19.4	18.5	1.4	60.7	100.0	

Table 21.—Gross annual growth of sawtimber on commercial forest land by species and by softwoods and hardwoods, Susitna Valley, Alaska, 1965

(In thousand board feet)[1]

Species	Total	Percent
Softwoods:		
White spruce	52,828	43.1
Black spruce	–	–
Total	52,828	43.1
Hardwoods:		
Paper birch	42,192	34.4
Cottonwood	26,769	21.8
Quaking aspen	847	.7
Total	69,808	56.9
All species	122,636	100.0

[1] *International 1/4-inch scale.*

Table 22.–Net annual growth of growing stock on commercial forest land by species and kind of volume, Susitna Valley, Alaska, 1965[1]

(In thousand feet)

Species	Kind of volume	
	Cubic feet	Board feet[2]
Softwoods:		
White spruce	8,811	45,084
Black spruce	311	–
Total	9,122	45,084
Hardwoods:		
Paper birch	13,551	40,437
Cottonwood	6,552	26,633
Quaking aspen	576	–
Total	20,679	67,070
All species	29,801	112,154

[1] *Because of the weakness of the mortality data, this table is of low accuracy.*

[2] *International 1/4-inch scale.*

Table 23.–Gross volume of annual mortality of growing stock on commercial forest land by species and by softwoods and hardwoods, Susitna Valley, Alaska, 1965[1]

Species	Thousand cubic feet	Percent
Softwoods:		
White spruce	1,496	60.7
Black spruce	–	–
Total	1,496	60.7
Hardwoods:		
Paper birch	886	36.0
Cottonwood	35	1.4
Quaking aspen	47	1.9
Total	968	39.3
All species	2,464	100.0

[1] *Because of the weakness of the mortality data, this table is of low accuracy.*

Table 24.–Gross volume of annual mortality of sawtimber growing stock on commercial forest land by species and by softwoods and hardwoods, Susitna Valley, Alaska, 1965[1]

Species	Thousand board feet[2]	Percent
Softwoods:		
White spruce	7,744	80.4
Black spruce	–	–
Total	7,744	80.4
Hardwoods:		
Paper birch	1,755	18.2
Cottonwood	136	–
Quaking aspen	–	1.4
Total	1,891	19.6
All species	9,635	100.0

[1]*Because of the weakness of the mortality data, this table is of low accuracy.*
[2]*International 1/4-inch scale.*

Table 25.–Gross annual mortality of growing stock on commercial forest land by cause and by softwoods and hardwoods, Susitna Valley, Alaska, 1965[1]

(In thousand cubic feet)

Cause	Softwoods	Hardwoods	All species	Percent
Insects	695	444	1,139	46.2
Diseases	161	–	161	6.5
Fires	–	158	158	6.4
Weather	103	–	103	4.2
Unknown	537	304	841	34.2
Logging	–	62	62	2.5
All causes	1,496	968	2,464	100.0
Percent	60.0	40.0	100.0	

[1] *Because of the weakness of the mortality data, this table is of low accuracy.*

Table 26.–Gross annual mortality of sawtimber growing stock on commercial forest land by cause and by softwoods and hardwoods, Susitna Valley, Alaska, 1965[1]

(In thousand board feet)[2]

Cause	Softwoods	Hardwoods	All species	Percent
Insects	3,650	587	4,237	44.0
Diseases	979	–	979	10.2
Fires	–	151	151	1.5
Weather	548	–	548	5.7
Unknown	2,567	1,153	3,720	38.6
Logging	–	–	–	–
All causes	7,744	1,891	9,635	100.0
Percent	80.4	19.6	100.0	

[1] *Because of the weakness of the mortality data, this table is of low accuracy.*

[2] *International 1/4-inch scale.*

Table 27.—Gross volume of growing-stock on commercial forest land by diameter class and species, Susitna Valley, Alaska, 1965

(In thousand cubic feet)

Diameter class[1]	Softwoods			Hardwoods				All species	Percent
	White spruce	Black spruce	Total	Paper birch	Cottonwood	Quaking aspen	Total		
5.0-6.9	40,117	2,618	42,735	58,846	5,657	4,408	68,911	111,646	6.5
7.0-8.9	82,484	643	83,127	108,709	16,428	5,908	131,045	214,172	12.5
9.0-10.9	140,853	–	140,853	168,961	15,559	5,936	190,456	331,309	19.4
11.0-12.9	79,286	–	79,286	180,518	19,958	8,402	208,878	288,164	16.8
13.0-14.9	59,575	–	59,575	160,336	30,139	3,292	193,767	253,342	14.8
15.0-16.9	51,847	–	51,847	83,341	27,904	–	111,245	163,092	9.6
17.0-18.9	13,757	–	13,757	30,873	27,265	–	58,138	71,895	4.2
19.0-20.9	7,465		7,465	15,982	54,450	–	70,432	77,897	4.6
21.0-22.9	–	–		5,846	39,513		45,359	45,359	2.7
23.0-24.9	–	–		–	26,969	–	26,969	26,969	1.6
25.0-26.9	–	–	–	1,771	31,556	–	33,327	33,327	2.0
27.0-28.9	–		–	1,359	28,079		29,438	29,438	1.7
29.0-30.9	–	–	–	–	18,295	–	18,295	18,295	1.1
31.0-32.9	–	–	–	–	19,197		19,197	19,197	1.1
33.0-34.9	–	–	–	–	9,895	–	9,895	9,895	.6
35.0-36.9	–	–	–	–	–				–
37.0-38.9	–	–	–	–	6,088	–	6,088	6,088	.4
39.0-40.9	–	–	–	–	4,089	–	4,089	4,089	.2
41.0 and larger	–	–	–	–	3,262	–	3,262	3,262	.2
Total	475,384	3,261	478,645	816,542	384,303	27,946	1,228,791	1,707,436	100.0
Percent	27.8	0.2	28.0	47.8	22.6	1.6	72.0	100.0	

[1] *Inches at breast height.*

Table 28.–Conversion factors, International 1/4-inch to Scribner scale volume

Diameter class	Spruce	Birch	Cottonwood	Aspen	All species
9.0 – 10.9	0.7976	–	–	–	0.7976
11.0 – 12.9	.8160	0.8000	0.7964	0.8058	.8069
13.0 – 14.9	.8344	.8132	.8423	.8151	.8248
15.0 – 16.9	.8554	.8194	.8526		.8430
17.0 – 18.9	.8719	.8237	.8575		.8518
19.0 – 20.9	.8801	.8259	.8624		.8602
21.0 – 22.9		.8281	.8645		.8624
23.0 – 24.9			.8655		
25.0 – 26.9			.8673		
27.0 – 28.9			.8677		
29.0 – 30.9			.8688		
31.0 – 32.9			.8695		
33.0 – 34.9			.8702		
35.0 – 36.9			–		
37.0 – 38.9			.8710		
39.0 – 40.9			.8713		
41.0+			.8719		
Average	.8205	.8101	.8605	.8073	.8304

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2. Development and evaluation of alternative methods and levels of resource management.
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1969 OREGON TIMBER HARVEST

by

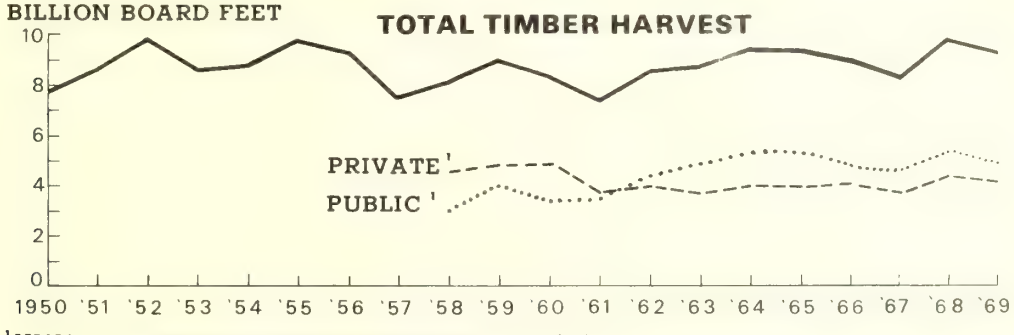
Brian R. Wall, *Associate Economist*

The 1969 Oregon timber harvest of 9.15 billion board feet was 6.1 percent below the 1968 16-year peak of 9.74 billion board feet. In western Oregon, the 1969 harvest was down 9.1 percent with public production and private production off 10.8 and 7.2 percent, respectively. By contrast, log harvest in eastern Oregon rose 5 percent, with private production up 13.2 percent and public up 2.5 percent.

Total Oregon private timber harvest in 1969 dropped 4.3 percent from the 1968 8-year high to 4.2 billion board feet. Harvest from forest industry-owned lands dropped 134.7 million board feet (3.8 percent), and other private owners' production declined 53.6 million board feet (6.5 percent) between 1968 and 1969.

Public timber harvest in Oregon declined 404.2 million board feet (7.5 percent) from the 1968 4-year high mark. The Bureau of Land Management had the largest production drop of 264.3 million board feet (18 percent) followed by the National Forests with a decline of 177.3 million board feet (4.9 percent). Timber harvest on Indian lands and other Federal lands declined 7.9 and 4.6 million board feet, respectively. Production rose 38.2 million board feet on State lands and 11.7 million board feet on other public lands during 1969.

The volume of uncut public timber under contract at yearend remained at the 8.2-billion-board-foot level recorded in December 1968, and the volume of public timber sold dropped slightly over 3 percent. Stumpage prices reached an alltime peak in the first quarter of 1969 and then dropped dramatically as evidenced by the 45-percent decline in the National Forest all-species-stumpage price from the first to the fourth quarter 1969. Because of the early and extreme price peak, the average public stumpage price for 1969 was above the 1968 average by 49 percent in western Oregon and 74 percent in eastern Oregon.



OREGON TIMBER HARVEST, 1950–69

PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
Philip A. Briegleb, Director
Portland, Oregon

FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE

Timber Harvest by Ownership in the State of Oregon, 1969[1/]

(In thousands of board feet, Scribner log scale)

State and county	Private[2/]			Bureau of Land Management[3/]	National Forest[4/]	Indian[5/]	Other Federal[2/]	State[2/]	Other public[2/]	Total
	Forest industry	Other	Total							
Western Oregon:										
Benton	18,174	19,162	37,336	42,032	5,212	--	--	12,975	--	97,555
Clackamas	119,675	32,206	151,881	33,856	271,708	--	--	674	6,700	464,819
Clatsop	246,637	4,808	251,445	--	--	--	--	24,484	1,457	277,386
Columbia	78,400	21,245	99,645	--	--	--	--	453	--	100,098
Coos	153,599	19,333	172,932	135,754	23,064	--	--	40,803	700	373,253
Curry	250,305	10,175	260,480	26,338	118,815	--	--	--	--	405,633
Douglas	802,104	60,295	862,399	359,017	414,665	--	--	34,723	780	1,671,584
Hood River	2,018	1,749	3,767	--	29,512	--	--	--	2,044	35,323
Jackson	206,478	18,366	224,844	111,752	115,937	--	--	--	--	452,533
Josephine	2,735	15,537	18,272	68,391	50,174	--	--	4,163	2,146	143,146
Lane	449,764	36,932	486,696	213,162	748,354	--	40	2,250	400	1,450,902
Lincoln	193,301	27,225	220,526	15,101	101,060	--	--	9,422	135	346,244
Linn	55,314	316,492	371,806	86,154	209,138	--	--	1,224	--	668,322
Marion	26,062	5,441	31,503	8,399	73,091	--	--	5,037	4	118,034
Multnomah	--	1,116	1,116	--	34,751	--	--	--	7,000	42,867
Polk	48,586	19,682	68,268	26,249	--	--	--	4,678	--	99,195
Tillamook	135,827	8,181	144,008	20,908	34,572	--	--	49,297	830	249,615
Washington	12,180	26,905	39,085	600	--	--	--	620	--	40,305
Yamhill	7,840	11,778	19,618	31,980	3,357	--	--	--	1,100	56,055
Total	2,808,999	656,628	3,465,627	1,179,693	2,233,410	—	40	190,803	23,296	7,092,869
Eastern Oregon:										
Baker	--	10,766	10,766	802	91,004	--	--	--	--	102,572
Crook	7,065	2,644	9,709	--	74,997	--	--	--	--	84,706
Deshutes	11,088	622	11,710	506	79,316	--	--	--	1	91,533
Gilliam	--	2,460	2,460	--	--	--	--	--	--	2,460
Grant	33,475	15,497	48,972	4,481	190,062	--	--	--	--	243,515
Harney	3,100	930	4,030	3,540	54,568	--	--	--	--	62,138
Jefferson	36,173	538	36,711	--	49,950	40,708	--	--	--	127,369
Klamath	235,527	26,188	261,715	15,502	197,612	--	--	7,886	--	482,715
Lake	181,913	9,973	191,886	3	129,995	--	--	--	--	321,884
Malheur	--	--	--	354	--	--	--	--	--	354
Morrow	8,165	773	8,938	--	939	--	--	--	--	9,877
Sherman	--	--	--	--	--	--	--	--	--	--
Umatilla	25,253	12,580	37,833	--	52,987	26	--	--	--	90,846
Union	15,460	11,494	26,954	816	75,054	--	--	870	--	103,694
Wallowa	22,430	12,059	34,489	322	129,883	--	--	--	--	164,694
Wasco	2,844	1,237	4,081	--	73,063	51,168	--	--	--	128,312
Wheeler	1,574	7,791	9,365	--	31,477	--	--	--	--	40,842
Total	584,067	115,552	699,619	26,326	1,230,907	91,902	--	8,756	1	2,057,511
Total, Oregon	3,393,066	772,180	4,165,246	1,206,019	3,464,317	91,902	40	199,559	23,297	9,150,380

1. Includes volume removed as logs, poles and piling, but not volume removed for woodcutting operations.

2/ Compiled by State Forester.

3/ Compiled by U.S. Bureau of Land Management.

4/ Compiled by U.S. Forest Service, Region 6.

5/ Compiled by U.S. Bureau of Indian Affairs.

Prepared by Forest Survey Project, Pacific Northwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, Portland, Oregon.

USDA Forest Service
Resource Bulletin PNW-34

June 1970

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TECH. & AGR. DIV.

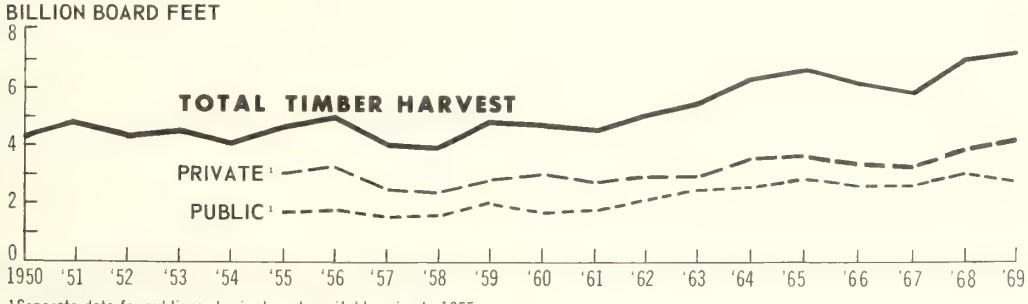
1969 WASHINGTON TIMBER HARVEST

by
Brian R. Wall, *Associate Economist*

Washington's timber harvest increased slightly in 1969 to a 40-year high of 7 billion board feet. This is slightly below the record timber harvest of 7.38 billion board feet established in 1929. Private timberland owners in western Washington increased their production 10.9 percent, accounting for most of the increase in the 1969 total harvest. In eastern Washington, private harvest declined 4.6 percent from the 1968 mark. On a statewide basis, forest industries increased their timber harvest by 214 million board feet (6.9 percent) and other private owners increased their harvest by 161 million board feet (21.7 percent).

Timber harvests on public lands dropped 11 percent in both western and eastern Washington between 1968 and 1969. The National Forests' timber harvest led the decline in public production with a 276-million-board-foot drop from the 1968 figure (down 15.4 percent), followed by a 109-million-board-foot decline on Indian lands (down 20.6 percent). The Bureau of Land Management's production was down 1.8 million board feet, other non-Federal public agencies' production declined 9.3 million board feet, and production by other Federal agencies declined 8.4 million board feet in 1969. By contrast, the 1969 timber harvest on State lands increased 63.6 million board feet (9.3 percent) above the 1968 figure.

Stumpage prices reached an alltime peak in the first quarter of 1969 and then dropped dramatically, as evidenced by the 45-percent drop in the National Forest average stumpage price for all species from the first to the fourth quarter of 1969. Because of the early and extreme price peak, the average public stumpage price for 1969 was above the 1968 average by 29 percent in western Washington and 72 percent in eastern Washington. The volume of uncut public timber under contract declined 8.5 percent during 1969, and the volume of public stumpage sold declined 1 percent in western Washington and rose 2 percent in eastern Washington.



[1]Separate data for public and private not available prior to 1955.

WASHINGTON TIMBER HARVEST 1950–69

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
Philip A. Briegleb, Director
Portland, Oregon

FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE

Timber Harvest by Ownership in State of Washington, 1969[1/]

(In thousands of board feet, Scribner log scale)

Half-State and county	Private[2]						State[2/]		Bureau of Land Management[4/]		National Forests[4/]		Indian lands[4/]		Other public[2]		Other Federal[2,5/]		Total production
	Industrial		Other		Total private														
	Live	Dead[3/]	Live	Dead[3/]	Live	Dead[3/]	Live	Dead[3/]	Live	Dead[3/]	Live	Dead[3/]	Live	Dead[3/]	Live	Dead[3/]	Live	Dead[3/]	
Western Washington:																			
Clallam	148,375	--	39,421	5	187,796	5	86,032	1,324	--	--	76,387	733	4,989	398	52	--	840	67	358,623
Clark	24,031	--	14,145	290	38,176	290	15,119	100	--	--	--	--	--	--	--	--	72	--	53,757
Cowlitz	399,768	--	31,990	--	431,758	--	82,310	3,156	--	--	10,271	40	--	--	--	--	3,499	--	531,034
Grays Harbor	312,607	--	123,345	980	435,952	980	15,161	62	--	--	54,582	5,623	164,314	4,178	28,289	142	--	--	709,283
Island	5,402	--	8,251	--	13,653	--	666	--	--	--	--	--	--	--	70	--	--	--	14,389
Jefferson	122,569	476	60,452	15	183,021	491	196,230	2,098	--	--	31,872	3,143	--	--	1,213	--	--	--	418,068
King	276,097	--	67,214	--	343,311	--	3,172	25	--	--	52,036	2,849	--	--	12,901	--	--	--	414,294
Kitsap	2,978	--	16,513	8	19,491	8	2,588	--	--	--	--	--	--	--	534	--	1,367	--	23,988
Lewis	485,026	--	58,498	125	543,524	125	44,353	--	--	--	205,536	5,746	--	--	--	--	--	30	799,314
Mason	40,418	--	34,745	7	75,163	7	15,215	--	--	--	75,092	907	--	--	2,334	--	--	--	168,718
Pacific	500,937	875	18,260	41	519,197	916	19,116	16	--	--	--	--	--	--	--	--	8	--	539,253
Pierce	257,443	--	57,263	70	314,706	70	13,355	13	--	--	38,187	28,380	--	--	340	--	15,021	1,126	411,198
San Juan	--	--	1,857	--	1,857	--	--	--	--	--	--	--	--	--	18	--	--	--	1,875
Skagit	196,915	--	23,881	611	220,796	611	34,300	75	--	--	41,009	4,920	--	--	1,944	55	--	--	303,710
Skamania	47,203	90	45,633	--	92,836	90	16,796	230	--	--	272,214	36,790	--	--	--	--	--	--	418,956
Snohomish	135,083	125	101,234	35	236,317	160	35,019	--	--	--	91,788	25,939	--	--	1,340	--	200	--	390,763
Thurston	68,686	--	36,321	420	105,007	420	12,729	--	--	--	--	--	--	--	--	--	136	--	118,292
Wahkiakum	91,126	160	9,296	57	100,422	217	15,255	--	--	--	--	--	--	--	3,200	--	--	--	119,094
Whatcom	60,100	--	25,755	--	85,855	--	19,665	--	--	--	23,235	5,135	--	--	--	--	7,316	--	141,206
Total	3,174,764	1,726	774,074	2,664	3,948,838	4,390	627,081	7,099	--	--	972,209	120,205	169,303	4,576	52,235	197	28,459	1,223	5,935,815
Total live and dead	3,176,490		776,738		3,953,228		634,180		--		1,092,414		173,879		52,432		29,682		5,935,815
Eastern Washington:																			
Adams	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Asotin	--	--	7,978	--	7,978	--	691	--	--	--	336	15	--	--	--	--	--	--	9,020
Benton	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chelan	17,341	--	3,401	--	20,742	--	1,130	87	--	--	69,821	593	--	--	--	--	--	--	92,373
Columbia	--	--	2,160	--	2,160	--	--	--	--	--	14,998	393	--	--	--	--	--	--	17,551
Douglas	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ferry	11,010	--	7,598	--	18,608	--	2,274	--	164	--	39,831	--	75,336	--	360	--	--	--	136,573
Franklin	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Garfield	--	--	452	--	452	--	--	--	--	--	14,296	69	--	--	--	--	--	--	14,817
Grant	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kittitas	17,300	--	28,910	1,298	46,210	1,298	14,957	--	--	--	26,952	1,851	--	--	102	--	--	--	91,370
Klickitat	49,832	--	9,375	--	59,207	--	16,470	426	--	--	3,756	63	--	--	--	--	--	--	79,922
Lincoln	--	--	4,270	--	4,270	--	869	--	--	--	--	--	--	--	--	--	--	--	5,139
Okanogan	2,750	--	13,264	420	16,014	420	28,241	--	874	--	100,431	3,487	18,250	--	--	--	--	--	167,717
Pend Oreille	9,240	--	12,480	--	21,720	--	6,573	--	6	--	59,559	2,382	515	--	70	--	--	--	90,825
Spokane	588	--	15,806	--	16,394	--	145	--	--	--	--	--	--	--	--	--	219	--	16,758
Stevens	30,693	--	14,116	--	44,809	--	14,758	116	1,214	--	16,742	--	12,795	--	--	--	4,300	--	94,734
Walla Walla	--	--	837	--	837	--	--	--	--	--	--	--	--	--	--	--	--	--	837
Whitman	--	--	100	--	100	--	--	--	--	--	--	--	--	--	--	--	--	--	100
Yakima	14,124	--	1,740	--	15,864	--	23,453	95	--	--	66,911	4,125	134,279	5,457	423	--	--	--	250,607
Total	152,878	--	122,487	1,718	275,365	1,718	109,561	724	2,258	--	413,633	12,978	241,175	5,457	955	--	4,519	--	1,068,343
Total live and dead	152,878		124,205		277,083		110,285		2,258		426,611		246,632		955		4,519		1,068,343
Total Washington	3,327,624	1,726	896,561	4,382	4,224,203	6,108	736,642	7,823	2,258	--	1,385,842	133,183	410,478	10,033	53,190	197	32,978	1,223	
Total live and dead	3,329,368		900,943		4,230,311		744,465		2,258		1,519,025		420,511		53,387		34,201		7,004,158

1/ Includes volume in logs, poles, piling, shingle bolts, etc.

2/ Compiled by the Department of Natural Resources.

3/ Includes snags and down material existing prior to initial logging.

4/ Compiled by respective agencies, U.S. Bureau of Land Management, U.S. Forest Service, U.S. Bureau of Indian Affairs.

5 Includes lands logged under jurisdiction of Bonneville Power Administration, National Park Service, U.S. Army, and U.S. Fish and Wildlife Service.

Prepared by Forest Survey Project, Pacific Northwest Forest and Range Experiment Station, U.S. Department of Agriculture, Portland, Oregon.

California's Forest Industries --Prospects for the Future

DANIEL D. OSWALD

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USDA FOREST SERVICE RESOURCE BULLETIN PNW-35

Pacific Northwest Forest and Range Experiment Station
Forest Service, U. S. Department of Agriculture
Portland, Oregon

1970

Foreword

This report has been prepared in recognition of the need for a current evaluation of the long-term prospects for forest industrial development in California. Emphasis is on the relationship between California's changing timber resources and its forest industrial development and employment.

This report is based upon a recently completed base-line study of the prospects for the timber economy of the California Water Resource Region made by the Pacific Northwest Forest and Range Experiment Station for the California Region of the U. S. Forest Service.[1] The original study was undertaken for the use and consideration of the Economic Subcommittee of the California Region Framework Study Committee. The results of that study will be included in the economics appendix of the California Water Resources Region Comprehensive Framework Study. The report presented here differs from the earlier study primarily because of a redefinition of the study area to exclude Klamath County, Oreg.

[1] *Oswald, Daniel D. Present and prospective development of the timber resources and forest industries in the California Water Resource Region. (Unpublished Pacific Northwest Forest and Range Exp. Sta. USDA Forest Serv. Admin. Rep.) 1969. 66 pp., illus.*

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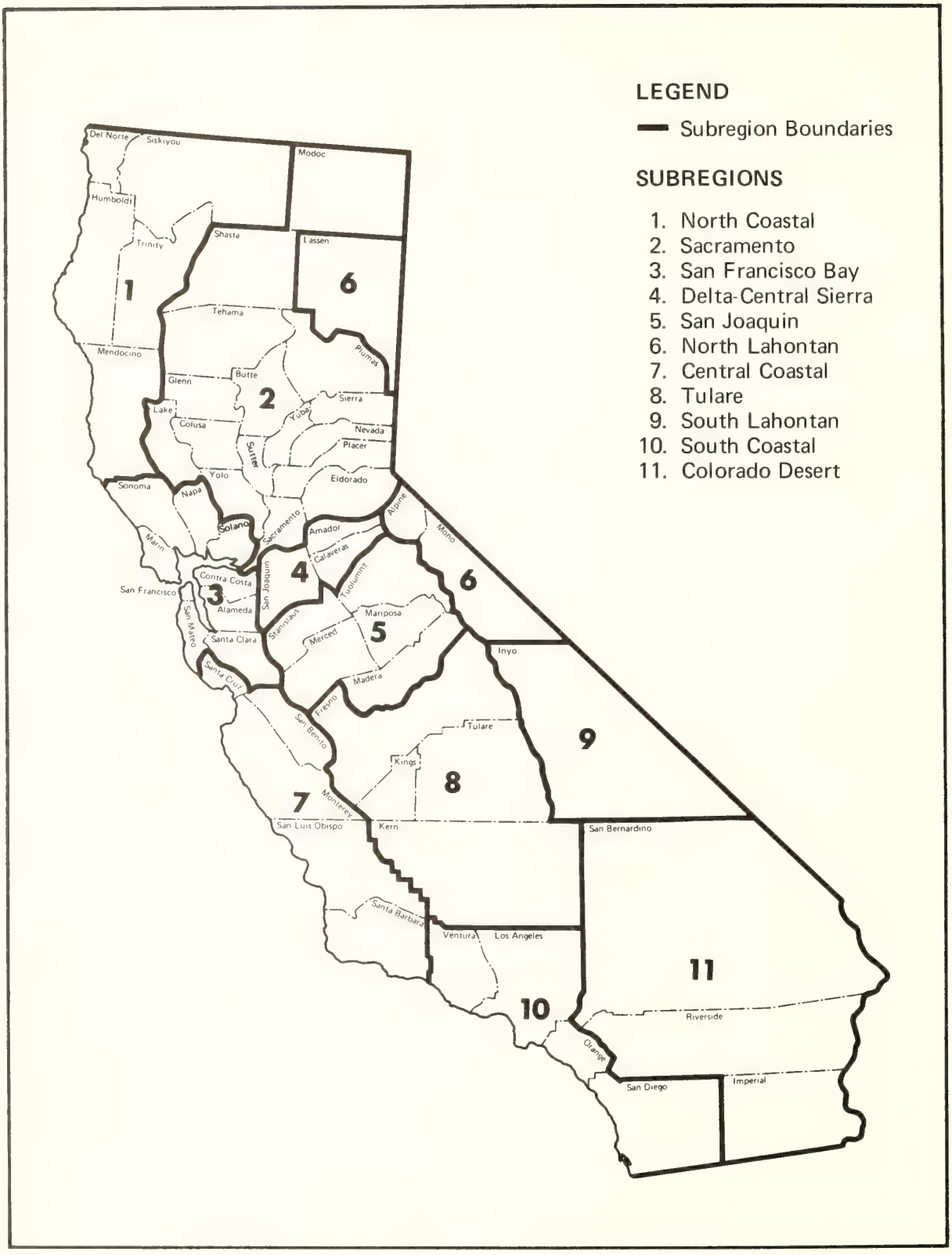

Figure 1. — California economic subregions.

Introduction

California's timberlands and forest products industries have played an important part in the growth of California's economy. Discovery of gold at the site of the first waterpowered sawmill in interior California triggered the gold rush of 1848, an event that led the California Territory into booming growth and statehood. Following that discovery, the lumber industry grew in inland California to meet demand for timbers and lumber in the mines and communities of the Mother Lode in California and the Comstock Lode in Nevada. On the coast, the lumber industry developed in response to needs for lumber in construction of San Francisco, other coastal communities, and the river communities of interior California. Both the coastal and inland areas had vast timber reserves readily available for conversion to lumber.

Historically, many communities in the State located at the sites of the early sawmills. The growth of those communities was determined by the success of the mills and the demand for lumber. Today, the State's economy is a diversified one in which forest products manufacture accounts for less than 5 percent of the value added in manufacture. But the forest products industries are still the major factor in many local and some regional economies within the State. For such areas, demand for forest products, as well as supply of raw material, dictates the health of the economy.

This study was undertaken to determine the probable future economic contribution of the forest resource and forest industries in California. The measure of economic contribution emphasized in the study is employment in the two major wood-using standard industrial classifications, lumber and wood products, and paper and allied products.

For purposes of analysis, California's 100-million-acre area has been divided into 11 water resource related subregions defined by county boundaries (fig. 1). These subregions are defined by the county boundaries most closely approximating the hydrological units used in planning by the State of California Department of Water Resources (California Department of Water Resources 1967).

The first part of this report contains a brief discussion of man's impact to date on California's forest resource and describes the resource as it exists today. The timber resource information contained in this report is based on an updating of the 1963 California Forest Survey timber inventory, which was reported in USDA Forest Service Resource Bulletin PSW-4 (Oswald and Hornibrook 1966).

The second part of this report is a discussion of recent and current activities in the forest industries. Trends in timber harvest are discussed, and recent development of the several forest industries is traced. This section also includes a geographic profile of the current forest industries and defines their contribution to the economies of the subregions shown in figure 1.

Future timber supplies are discussed in the third section of the report. This section also presents the underlying assumptions concerning local and national demand for wood products, the future availability of land for timber production, intensity of forest management,

and trends in harvest and utilization. Estimates of future growth and inventories are also presented.

Projections of forest industrial development are based on an allocation of the projected timber harvest to the major forest industrial sectors. Projected development in these sectors is expressed in terms of raw material consumption and forest industrial employment. The implications of the prospective forest industrial development and employment are discussed in this and the concluding section of the report.

The base year for the projections developed in this study is 1965. Output years for projected resource supply and related economic activities are 1980, 2000, and 2020. The "plan period" referred to in the study is the 55-year projection period, from base year 1965 to final output year 2020.

Detailed tables of the resource, present and projected production and employment, and forest industry development are presented in Appendix A. Definition of terms used in the text are in Appendix B.

The projections in this report should not be considered as predictions of what will be the situation in the output years. Rather, they represent estimates of levels of activity expected for those years within the framework of the assumptions made. The projections contained herein are base-line projections. As such, they represent expectations for wood supply and related economic activity assuming ongoing trends. If projections are to serve their main function, they will result in plans of action that will alter some of the inputs, invalidate some of the original assumptions, and result in different levels of activity than originally projected.

The forest resource -- its historical use and current status

California's rich forest resource was scarcely affected by man until little over a century ago. The native inhabitants had little impact on the forests of this region. Their consumption of wood was negligible, probably confined to the use of forest litter for fuel. Their major impact — its extent unknown — was in the use of fire to clear forested areas. The establishment of mission settlements, small agricultural communities, and the Spanish land grant ranches that accompanied Spain's claim to the region probably marked the first consumptive use of the forest resource. Limited amounts of wood were used for building, in addition to its use as fuel. However, impacts on the forest resource were minimal and very localized.

Significant exploitation of the forest resource and development of forest industry began with the discovery of gold in California in 1848. Early logging and milling activities were confined to the more easily accessible areas along the coast and areas close to the mining centers in the central Sierra Nevada. The species used in the early days of logging activity were primarily redwood for construction in the cities around San Francisco and pines in the mining regions of California and Nevada.

Following the initial period of mining activity, population increases and resultant growth of coastal and interior cities resulted in more or less continuous growth in harvesting activities through the remainder of the 19th century and the first two decades of this century. The primary end product, lumber, was used in local markets; exports in the late 1800's played only a small part in the growth of the industry. In the early 1920's, harvesting activities and lumber production experienced sharp increases to new highs, which lasted through 1929.

Following the early depression years during which timber harvest and lumber production dropped to one-third of the 1929 total, the annual harvest and lumber production resumed an upward trend. By 1940, the harvest level had reached the 1929 level. Timber harvest stabilized during the war years. Following the war, harvest levels in California resumed the prewar upward trend, carrying lumber production to all time highs in the mid-1950's and providing the raw material for tremendous growth in an essentially new industry for California, the softwood plywood industry. Timber harvest levels in the 1960's declined moderately from the mid-1950's peak, with accompanying declines in lumber and plywood production. It is estimated that California's forests have yielded over 200 billion board feet of timber products over the last 120 years.

The long history and localized nature of lumbering and timber harvest in California and the changes in species used have resulted in a forest resource of rather complex structure. Large areas of mature, young-growth timber are concentrated in the North Coastal and Central Sierra subregions of the State, primarily on private land. But much of the State is still stocked with old-growth sawtimber stands, mostly on National Forest lands. Large areas of commercial forest land that were formerly stocked with conifers are now poorly stocked or are stocked with hardwoods of little or no

commercial value. This condition occurs primarily on private lands in the North Coastal subregion. Much of the area in this condition has resulted from unsuccessful attempts at conversion to grazing following removal of the original conifer stands. In many areas of the State, selective logging of valuable commerical species from mixed stands has created multistory stands and stands with species composition that is different from that of the original stand.

In the wake of the gold rush, the population influx into the State and resultant cultural development had considerable impact on the

Figure 2. — Forest areas of California.

availability of forest lands for the production of wood products. Historically, the major impact was the conversion of timberlands for farming and grazing, activities that have accompanied the settlement of most regions in the United States. With continued population growth, the needs and demands of a huge population centered in large urban complexes have now reached the most remote areas in the State. These demands — for water, power, roads, and mountain recreation — have all taken timberlands out of timber production. Although the extent of California's original forests is unknown, study of available information regarding the forest resource and its use leads to the conclusion that a very substantial majority of the original forest-land area in California remains forested.

Forests Occupy 42 Percent of State's Land Area

Today, over 42 million acres of California's 100-million-acre land area are forested. The forested areas extend through the length and width of the State and are generally absent only in the Central Valley and the desert region of southeastern California (fig. 2).

Commercial forest lands[2] available for the production of timber total over 17 million acres, 17 percent of the State's land area. The commercial forests extend throughout the Coast Ranges from Monterey Bay northward to the Oregon border; they extend across the southern reaches of the Cascade Range in the northern part of the State; and they blanket much of the Sierra Nevada through its entire length. Only scattered patches of commercial forest land occur in the mountains of southern California (fig. 2).

Commercial Forest Area Concentrated in Two Northern Subregions

The North Coastal and Sacramento subregions combined account for 77 percent of the available commercial forest area in California — 7.2 million acres in the North Coastal subregion, and 6.2 million acres in the Sacramento subregion. The remaining 4 million acres are scattered over the other nine subregions (table 1).

[2] *Definitions of terms used in this report are given in Appendix B.*

Table 1. — Area of land by subregion and forest-land classes, California, 1965
(In thousand acres)

Subregion	Total land area[1]	Total forest-land area	Forest land		
			Commercial	Unproductive	Productive reserved
All subregions	100,207	42,416	17,345	23,816	1,255
North Coastal	11,255	9,683	7,156	2,122	405
Sacramento	17,383	11,374	6,249	4,975	150
San Francisco Bay	4,450	1,772	418	1,316	38
Delta-Central Sierra	1,939	919	382	536	1
San Joaquin	5,988	2,866	916	1,679	271
North Lahontan	5,311	2,334	1,055	1,250	29
Central Coastal	7,175	3,528	152	3,361	15
Tulare	13,023	4,393	771	3,282	340
South Lahontan	6,462	666	7	659	--
South Coastal	7,006	3,146	103	3,040	3
Colorado Desert	20,215	1,735	136	1,596	3

[1] *Source: 1964 Census of Agriculture, U. S. Bureau of the Census.*

The North Coastal subregion consists of five northwestern California counties. It is a sparsely populated mountainous area that is 86 percent forested — two-thirds, by commercial forests. This subregion contains most of California's redwood and Douglas-fir forests as well as considerable areas of true firs, pine, and mixed stands of conifers. It is the most important wood-producing area in California.

The Sacramento subregion is comprised of 16 northern California counties. Two-thirds of the area is forested, about half of which is occupied by commercial forests located in the mountainous areas to the east, north, and west of the extensive farmlands of the Sacramento Valley. The commercial forests of this subregion consist mainly of pine and mixed stands of pine, Douglas-fir, and true firs. This area is the second most important wood-producing area in the State. It is the center of the California pine industry and of a secondary manufacturing industry based upon the pine resource.

Of the remaining subregions, San Francisco Bay, Delta-Central Sierra, San Joaquin, North Lahontan, and Tulare have locally important but relatively small commercial forest acreages. Pine and mixed conifer forests prevail in all but the San Francisco Bay subregion, which has redwood and Douglas-fir forests. The stands of commercial species in the Central Coastal, South Lahontan, South Coastal, and Colorado Desert subregions are small and scattered and have little importance for timber production.

Commercial Forest Ownership Almost Evenly Divided Between Public and Private Owners

Public ownership accounts for 9.3 million acres or 53 percent of the State's commercial forest acreage.[3] The National Forests, with 8.7 million acres, account for most of the public commercial forest land. Private ownerships account for 8.1 million acres, 47 percent of the total. In the North Coastal subregion, 51 percent of the commercial forest acreage is in private ownerships, and National Forests account

[3] *The resource inventory data contained in this section are for 1965, the base date for the study.*

Table 2. — Area of commercial forest land by subregion and ownership class, California, 1965

(In thousand acres)

Subregion	Total	National Forest	Other public	Private
All subregions	17,345	8,710	543	8,092
North Coastal	7,156	3,186	316	3,654
Sacramento	6,249	3,265	153	2,831
San Francisco Bay	418	---	10	408
Delta-Central Sierra	382	98	22	262
San Joaquin	916	637	7	272
North Lahontan	1,055	612	28	415
Central Coastal	152	15	5	132
Tulare	771	690	1	80
South Lahontan	7	5	---	2
South Coastal	103	84	1	18
Colorado Desert	136	118	---	18

Source: USDA Forest Service.

for 45 percent; other public, the remaining 4 percent. In the Sacramento subregion, National Forests contain 52 percent of the commercial forest area; private ownership, 45 percent; and other public, 3 percent. None of the other subregions display the balanced forest ownership pattern evidenced in these two main timber resource subregions. The San Francisco Bay subregion's commercial forest lands are privately owned, but in the remaining subregions, National Forest ownership dominates. In none of the subregions is the "other public" ownership category of major importance relative to the other ownerships (table 2).

Three-Fourths of Commercial Forest Area Contains Sawtimber Stands — Old Growth Still Prevails

Of 12.8 million acres of sawtimber stands on California's commercial forest area, 8.7 million acres are classed as old growth (Oswald and Hornibrook 1966). Two-thirds of the old-growth acreage is on National Forest lands, which have a relatively short cutting history. These old-growth stands occur throughout most of the State. Some have been cut on a selective basis that has little changed the age of the stands. Young sawtimber stands are found throughout the State also but are primarily in the redwood type areas of the North Coastal subregion and in pine and mixed conifer forests of the Sacramento and Delta-Central Sierra subregions. Almost two-thirds of the area of young sawtimber stands is in private ownership.

Most of Sawtimber Inventory Is in Two Northern Subregions

Seventy-seven percent of California's sawtimber inventory of 299 billion board feet is concentrated in two subregions; the North Coastal subregion has 132 billion board feet and the Sacramento subregion has 98.5 billion board feet. The San Joaquin, Tulare, and North Lahontan subregions contain 21.3, 19.8, and 11.1 billion board feet, respectively, of the State's sawtimber. The other subregions contain lesser amounts (table 3).

Table 3. — Volume of sawtimber on commercial forest land by subregion and owner group, California, 1965 (International 1/4-inch scale)

(In million board feet)

Subregion	All owners	National Forest	Other public	Private
All subregions	299,064	159,328	7,681	132,055
North Coastal	132,089	54,918	5,487	71,684
Sacramento	98,523	57,689	1,104	39,730
San Francisco Bay	5,565	---	188	5,377
Delta-Central Sierra	6,435	3,097	172	3,166
San Joaquin	21,311	16,139	97	5,075
North Lahontan	11,094	7,749	180	3,165
Central Coastal	1,468	183	15	1,270
Tulare	19,784	17,293	437	2,054
South Lahontan	82	56	---	26
South Coastal	1,517	1,262	1	254
Colorado Desert	1,196	942	---	254

Over Half of Sawtimber Volume Is in Public Ownerships

Fifty-six percent of the State's sawtimber volume is held in public ownerships. National Forests contain 159 billion board feet or 53 percent of the State's total. Of the 132 billion board feet of privately owned timber, about 37 percent is owned by forest industry, and 63 percent is owned by farmers and other miscellaneous private owners.

The percentage of total sawtimber in public ownership varies from subregion to subregion. In the North Coastal subregion, 46 percent of the sawtimber volume is publicly owned, and in the Sacramento subregion, 60 percent. In the North Lahontan, San Joaquin, and Tulare subregions, publicly owned sawtimber accounts for 71, 76, and 90 percent, respectively (table 3).

Douglas-fir Is Most Abundant Species

No single species accounts for a majority of the sawtimber volume. Douglas-fir is most abundant, accounting for about 30 percent of the total, followed by the true firs with 27 percent, ponderosa pine with 19 percent, and redwood with 9 percent. Hardwoods account for only 2 percent of the State's sawtimber volume.

Recent trends and current activity in the forest products industries

The forest products industries in California — as they exist today — reflect the substantial changes that have occurred since World War II. During the postwar period, the forest products industries developed significant product diversity for the first time by addition of woodpulp, board, and plywood manufacture to the historically dominant lumber industry. Timber harvest and forest products output have been higher in every year of the postwar era than at any previous time.

Log Production

The post-World War II trend in California log production has been shaped to a large degree by the changing availability of Douglas-fir in the North Coastal subregion. The early years of log production were dominated by the pines from the interior mining regions. Between 1880 and 1920, redwood was the leading species harvested. From 1920 until 1950, ponderosa pine again led all other species in amount harvested. At that time, Douglas-fir became the most important timber species, a position it has not relinquished to date.

In 1946, Douglas-fir accounted for only 19 percent of California's log production. Its share of State log production increased to 36 percent in 1952, and 44 percent in 1956. By 1962 the Douglas-fir share had decreased to 38 percent; and in 1968, only 32 percent of California's log production was Douglas-fir.

Before Douglas-fir became a leading species, the Sacramento subregion was the main contributor to the State's log production. In 1946, it accounted for 45 percent of California's 3 billion-board-foot cut; the North Coastal subregion supplied 28 percent; and the other subregions combined supplied 27 percent. In 1948, the North Coastal subregion surpassed the Sacramento subregion in log production (fig. 3). The emergence of the North Coastal subregion as the predominant log supply region came at a time when production trends in the remainder of the State were stable. By 1955, the peak year for California's log production, the North Coastal subregion accounted for 55 percent of the State's 6 billion-board-foot log production. During the period 1946-55, the North Coastal subregion's log production quadrupled; that of the Sacramento subregion showed an increase of 22 percent; and the other subregions combined had an increase of 29 percent.

Although Douglas-fir in the North Coastal subregion was the main contributor to increased log production in the 10 years after the war, redwood log production also increased in this subregion, reaching new highs annually from 1950 through 1956. Zivnuska et al. (1965) recognized the reason for the tremendous postwar growth in log production in the North Coastal area. In the late 1940's, Douglas-fir forests of California's North Coastal subregion and southwestern Oregon represented the "last frontier" in terms of large tracts of privately owned old-growth timber in the United States. This available supply of raw material, coupled with the demand generated by the postwar housing boom in nearby southern and central California, triggered the rapid expansion of log production and forest pro-

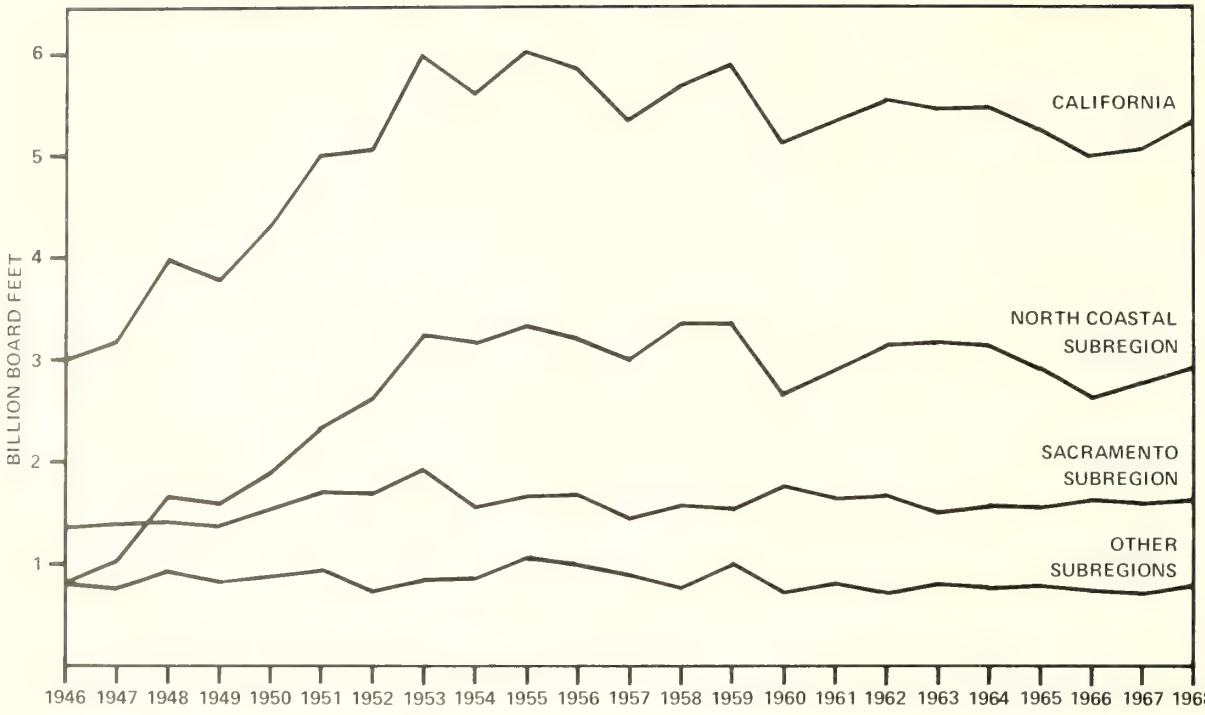

Figure 3. — Log production in California and selected subregions 1946-68. (Source: California Division of Forestry and USDA Forest Service.)

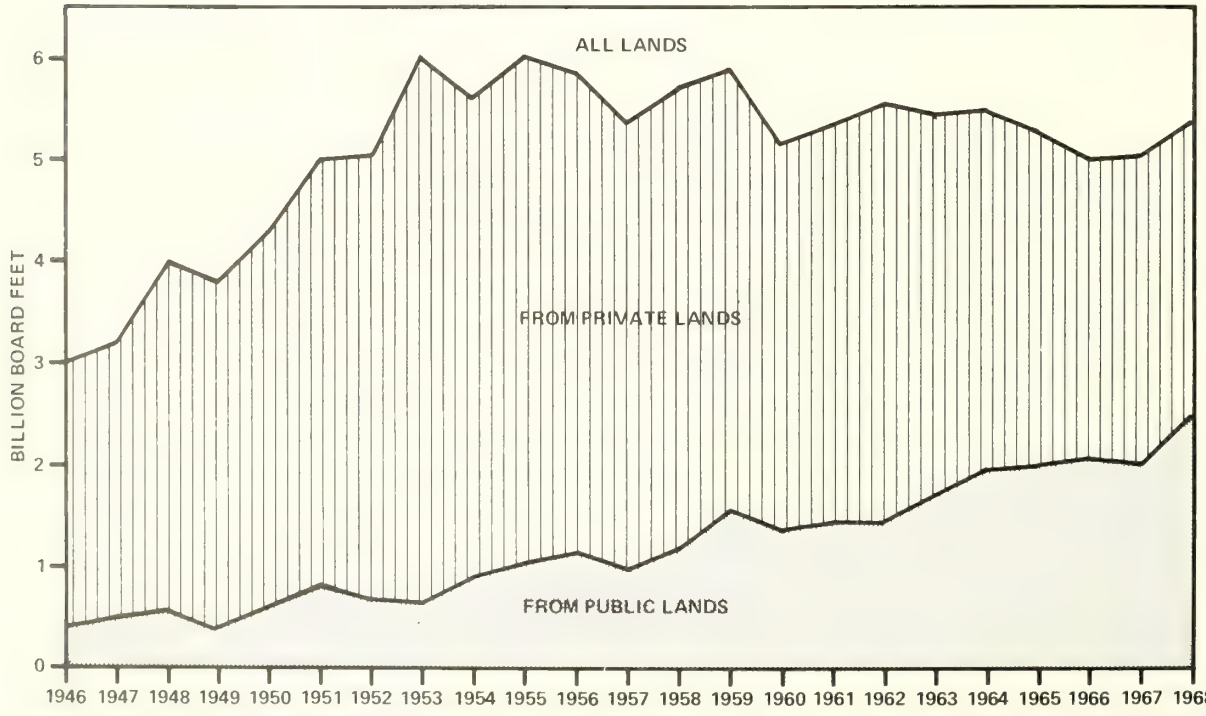

Figure 4. — Log production in California by owner, 1946-68. (Source: California Division of Forestry and USDA Forest Service.)

ducts manufacture in the North Coastal subregion.

Since the mid-1950's, the trend in California log production has been downward. Log production in the base year 1965 and in 1968 was about 5.3 billion board feet, a decrease of 11 percent from the 1955 level. In both 1965 and 1968, the North Coastal subregion accounted for 55 percent of the State's log production, compared with 30 percent for the Sacramento subregion and 15 percent for the other subregions combined.

Log production in the Sacramento subregion has changed little since the mid-1950's. In the North Coastal subregion, log production has fallen 12 percent from the high levels of the mid and late 1950's because of a decrease in the production of Douglas-fir. The privately held old-growth reserves of Douglas-fir, primarily on farmer and miscellaneous private holdings in the North Coastal subregion, have been rapidly depleted.

Log production in the other subregions combined dropped 24 percent from 1955 to 1968 — contributing substantially to the statewide decline in log production that has occurred since the 1950's. Within this group of smaller subregions, only the Tulare and San Joaquin have shown an upward trend in log production in recent years. The Delta-Central Sierra, North Lahontan, and San Francisco Bay subregions experienced 25-, 61-, and 68-percent declines in log production from 1955 through 1968.

The moderate decline in California's log production in recent years tends to mask the decreasing availability of private timber. During the period 1955-68, total log production in the State decreased 11 percent but log production on private lands decreased 43 percent. During the same period, log production from public lands — primarily National Forests — increased 240 percent, making up for most of the decline in private log production (fig. 4).

The recent subregional trends in log production reflect subregional timberland ownership patterns. In the North Coastal and Sacramento subregions, public and private ownerships are in approximate balance, and increases of allowable cuts in publicly held old-growth timber have offset substantially the declines in private timber harvest. Forest-land ownership in the Delta-Central Sierra and San Francisco Bay subregions is predominantly private; hence, public holdings are not available to offset the log production declines that have come with depletion of privately held old-growth timber. The Tulare and San Joaquin subregions have predominantly public forests. Increased allowable cuts on these lands have more than offset declining private harvests in recent years.

The North Lahontan subregion has experienced declining log production, even though it has more public than private timberland. However, unlike most of the other subregions, this subregion's public forests have experienced an active continuous public sales program dating back to about 1920. Thus, no large reserve of public old-growth timber was available to offset declining private timber harvests in the last 20 years.

The Lumber Industry

The lumber industry has historically been the major component of the forest industries in California. Only since World War II has there been significant development of other primary wood using industries. In 1965, the State's lumber industry produced 5 billion board feet of lumber, 14 percent of the national total. Virtually all of the lumber produced was softwoods — 17 percent of the Nation's softwood production for that year. California's lumber industry has utilized over 85 percent of the annual roundwood harvest in recent years.

The postwar period has been the most active period in California lumber industry history. Lumber production, which had reached new highs of about 2.3 billion board feet during the war years, increased to almost 4 billion board feet in 1948. The industry's growth during this period occurred in both of the State's lumbering regions.[4]

[4] *The California redwood lumber region has been defined by the Bureau of the Census to consist of the following counties: Del Norte, Humboldt, Mendocino, Sonoma, Marin, San Francisco, Contra Costa, Alameda, San Mateo, Santa Clara, Santa Cruz, and Monterey. The region approximates this study's North Coastal, San Francisco Bay, and Central Coastal subregions combined. The pine lumber region embraces the remainder of the State, and approximates the remainder of this study's subregions. Lumber industry trends in each of the two lumber regions adequately reflect trends that have occurred in the grouped subregions.*

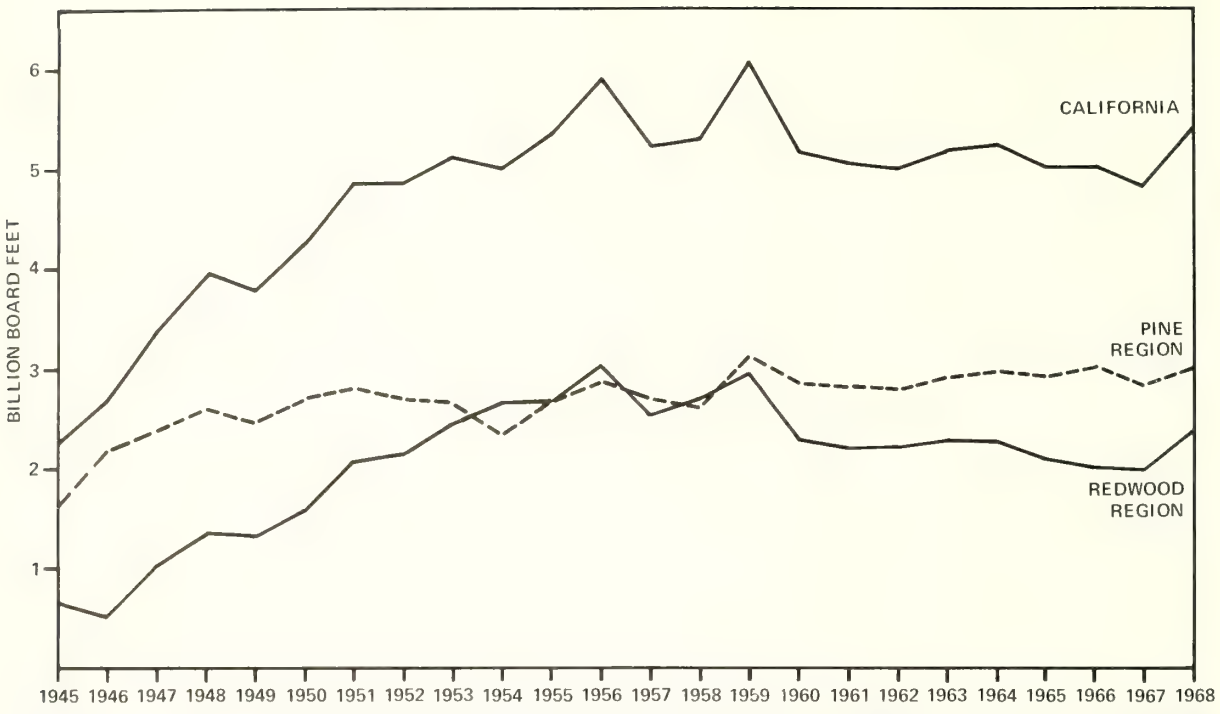

Figure 5. — Lumber production in California by lumber region, 1945-68. (Source: U. S. Bureau of the Census.)

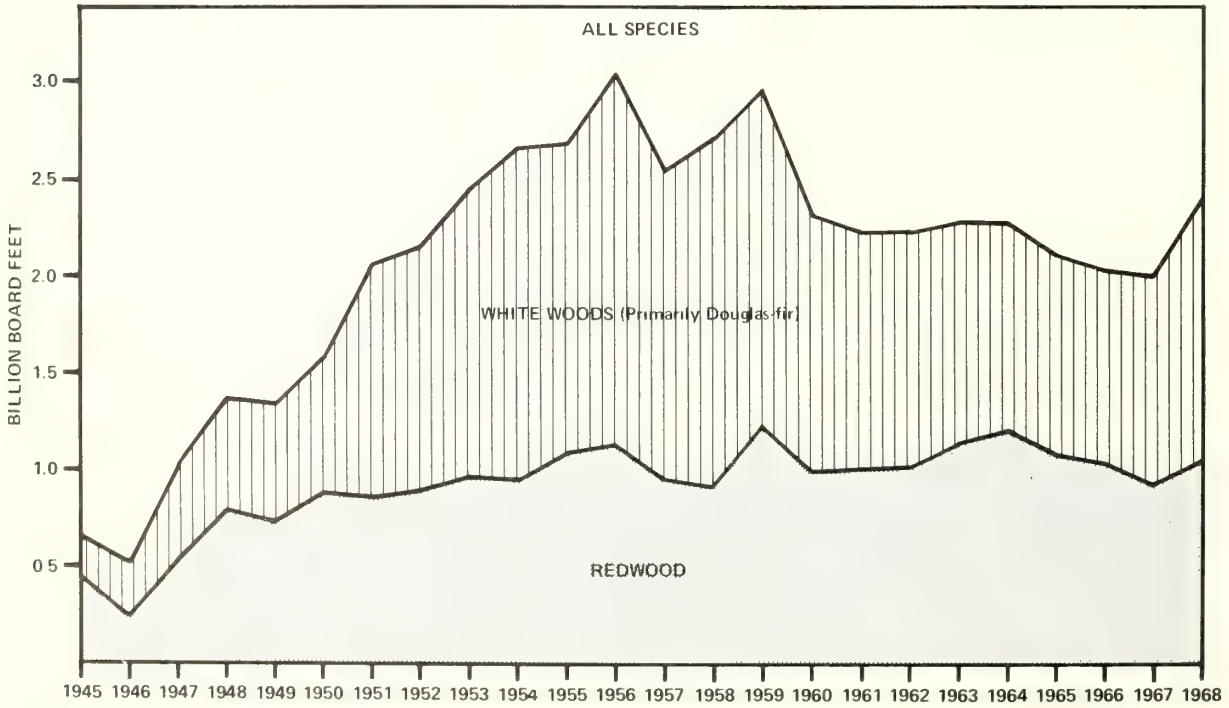

Figure 6. — Lumber production in the California redwood lumber region by species groups, 1945-68. (Source: U. S. Bureau of the Census.)

Lumber production continued to climb in the early 1950's and in 1956 peaked at 5.9 billion board feet. The increase in lumber production during this period was concentrated in the redwood lumber region and was primarily due to the growth of the Douglas-fir lumber industry (figs. 5 and 6).

After a decline in 1957-58 caused by a general economic slowdown, California lumber production reached an all-time high of 6 billion board feet in 1959. From 1953 through 1959, the two lumber regions were equal contributors to the State's total production. In 1960, statewide production fell sharply to 5.2 billion board feet, and three-fourths of the production decline was concentrated in the redwood lumber region. Since 1960, statewide lumber production has fluctuated little. During this period, a downtrend in the redwood lumber region has been countered by an upward trend in the pine lumber region (fig. 5).

In the redwood lumber region, redwood lumber production trended upward from 1945 to the mid-1960's. But Douglas-fir production peaked in 1956 and has trended downward since then. In 1964, redwood lumber production exceeded that of Douglas-fir in the redwood lumber region for the first time since 1950 (fig. 6). The decline in Douglas-fir lumber production in this region since 1956 — after its meteoric rise during the first half of that decade — probably resulted from two factors.

The plywood industry is centered in the redwood lumber region and competes directly with the lumber industry for raw material, namely Douglas-fir roundwood. From 1947 through 1964, the plywood industry yearly increased its share of the Douglas-fir harvest. By the early 1960's, plywood plants in the redwood lumber region were receiving one-third of a diminishing harvest of Douglas-fir roundwood (Muerle and Hornibrook 1965). But the major factor underlying the declining lumber production is the decreasing availability of Douglas-fir timber.

In the late 1940's and early 1950's, there was a seemingly endless supply of Douglas-fir stumpage in northwestern California. It was the most abundant species in the area and had been generally neglected by the resident redwood industry. Most of the Douglas-fir harvested in the 10 years following World War II came from the many small ownerships in the farmer and miscellaneous private category that held much of the Douglas-fir resource. Hundreds of sawmills — mostly small in size — entered the industry to process the Douglas-fir. The expansion peaked in the mid-1950's, and by the end of the decade, the available supply of raw material had tightened as Douglas-fir on small private ownerships was cut out.

In the pine lumber region of California, pine lumber production peaked in 1948 and has declined gradually since that time. However, increased production of white fir and Douglas-fir lumber in this region has more than offset the decline in pine production. The result has been an almost continuous uptrend in total lumber production since World War II (fig. 5).

The makeup of the sawmilling industry changed rapidly after World War II. From the 1850's through the 1930's, the mill count fluctuated between 150 and 320 mills, with a trend toward fewer and larger installations. The number increased substantially in the early 1940's and by 1945 stood at about 450. By the following year, there were over 900 sawmills, as hundreds of small mills went into operation after the end of the War. The mill count rose to almost 1,000 by 1948, the high point for number of mills in the State and also for number of small mills (fig. 7).

The small mills were important during a period when sharp increases in demand for lumber called for rapid expansion of productive capacity. By the end of the 1940's, capacity added in medium and large size mills had started to replace the smaller inefficient operations, and the trend toward larger mills was resumed. The number of medium to large mills peaked with lumber production in 1956, but the total mill count dropped below 700. By 1962, there were less than 300 mills in California. Medium to large mills, which accounted for 62 percent of the production in 1948, produced 90 percent of the State's 1962 production. By 1968 the mill count had dropped to 216 sawmills. These mills produced about the same amount of lumber as did 800 mills in 1951, indicating the strong trend toward larger mills in recent years. More detailed information on numbers of sawmills is presented in table 6 of Appendix A.

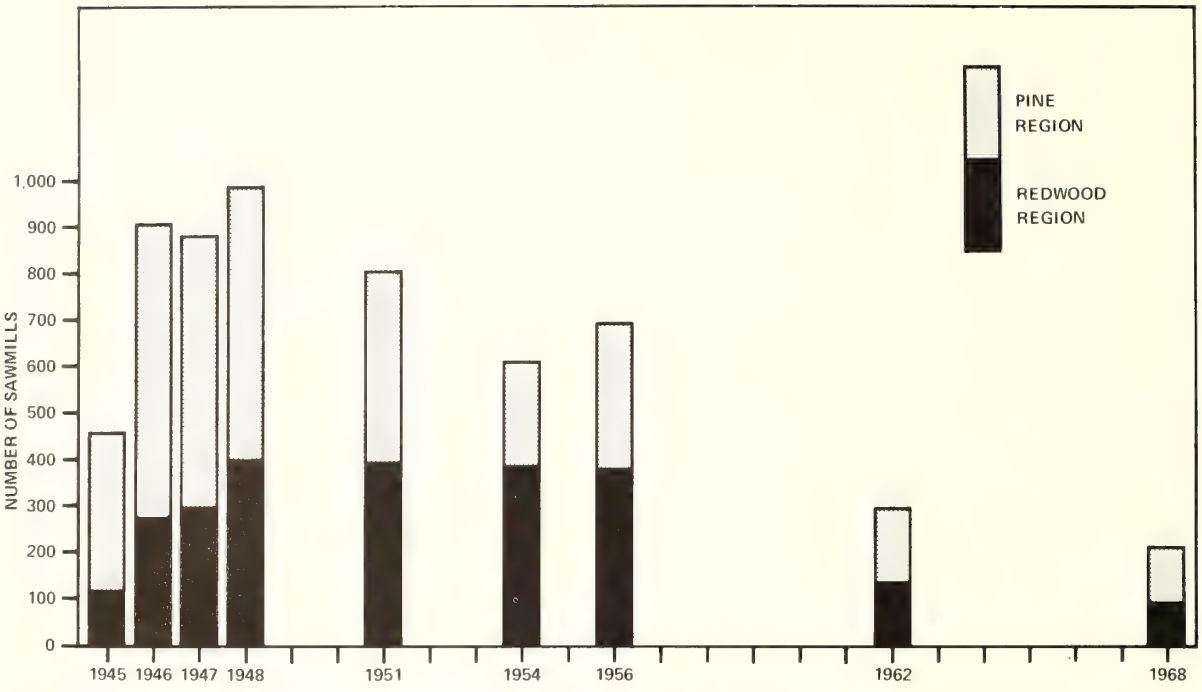

Figure 7. — Number of active sawmills in California by lumber region, 1945-68. (Source: USDA Forest Service.)

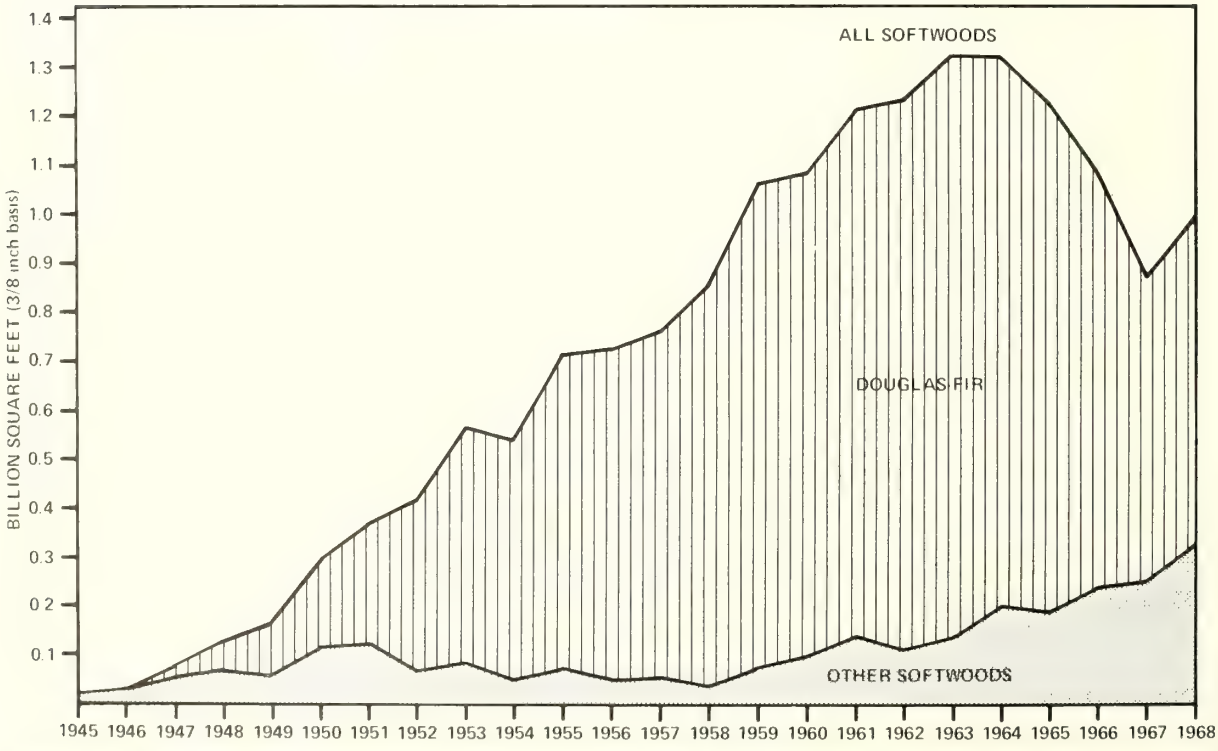

Figure 8. — Softwood plywood production in California by species, 1945-68. (Source: U. S. Bureau of the Census and USDA Forest Service.)

The Plywood Industry

Although the origin of California's plywood industry dates back to the 19th century, the industry was of little importance until Douglas-fir plywood production commenced in the coastal area of northern California in 1947. From that time, plywood production increased yearly with the addition of new plant capacity and peaked in 1963-64. In 1965, softwood plywood production in California totaled 1,222 million square feet (3/8-inch basis), 10 percent of the Nation's softwood plywood production. California had accounted for over 14 percent of the national totals in 1961 and 1962. The magnitude of the contribution of Douglas-fir to growth in the plywood industry is illustrated in figure 8.

Since 1964, plywood production in California has dropped off sharply, even though national production of softwood plywood has continued to climb. From 1964 to 1968, production fell 25 percent, led by a 40-percent decrease in Douglas-fir plywood production. During that same period, although production of white fir, pine, and redwood plywood combined increased 60 percent, the volume increase was not nearly enough to offset the losses in Douglas-fir production. The magnitude of the impact of dwindling supply of raw material on the Douglas-fir production decline is not yet known. During the same period, there was a downturn in residential construction in California — the major market for California-produced Douglas-fir plywood. However, increases in production of other softwood plywoods in California and continued growth in Douglas-fir plywood production in the Northwest during this period strengthens the assumption that supply of raw material is a major factor in the decline of Douglas-fir and total softwood plywood production in California.

The softwood plywood industry is concentrated near the Douglas-fir resource in the North Coastal subregion. This subregion has also been the location of green veneer plants which peel logs and sell the veneer to layup plants. Such operations, numerous during the expansion period, have diminished considerably in recent years. Pine and white fir plywood production is concentrated in the inland subregions, and hardwood plywood production is located near markets in the South Coastal subregion.

The Board Industries

The development of the board industries in California, which began in 1950-51, has been based on the use of wood residues from the lumber and plywood industries. Initial development consisted of one hardboard plant in the North Coastal subregion and a particleboard plant in the Sacramento subregion. Although no additional hardboard plants have been built in California, hardboard production has increased through expansion of capacity in the existing plant. Hardboard production in 1965 was 310 million square feet (1/8-inch basis), 10 percent of the total national production (Anonymous 1966).

Particleboard production has climbed rapidly since the mid-1950's, owing to expansion of existing facilities and construction of new plants. In 1965, particleboard production was 146 million square feet (3/4-inch basis), about 18 percent of the Nation's production for that year (Anonymous 1966).

The Pulp Industry

Although the pulp and paper industry has a long history in California, successful large scale woodpulp operations have their origins in the post-World War II period. Like the board industries, the woodpulping plants have developed and expanded through the use of wood residues from the lumber and plywood industries. California's first major pulpmill was built in the San Francisco Bay subregion in 1948. Production of woodpulp increased gradually during the 1950's because of expansion of the existing facility and addition of a pulpmill in the Sacramento subregion. Three large pulpmills were added in the 1960's, two in the North Coastal subregion, and one in the Sacramento subregion. Statistics for California's woodpulp production are not available. However, based upon installed capacity in operation, woodpulp production is estimated at about 315,000 tons in 1965. Based upon increases in installed capacity since 1965, 1968 production is estimated at about 700,000 tons, less than 2 percent of the Nation's total.

Exports

The foreign log and pulpwood market was of little importance in California until recently. Log exports amounted to only 15 million board feet in 1965, and there were no chip exports at that time. But since then, exports of both commodities have grown rapidly, following the lead of the Pacific Northwest. Almost all of the exported wood — in both forms — goes to Japan. The amount of logs and chips shipped to Japan and other destinations in 1968 was significant — 212 million board feet of logs and 192,000 tons of chips. Most of the exported logs originated in the North Coastal subregion and were shipped from Eureka, a North Coastal port. The exported chips originated primarily in the inland subregions and were exported from Sacramento, an inland port which also handles export logs.

Subregional Distribution of Industries, 1965

For many years, the level of forest industrial development and its geographical distribution within California have reflected both resource availability and the presence and growth of major market areas. Harvest of raw material and the initial steps of manufacturing that involve large weight loss are necessarily resource oriented. Industries engaged in secondary manufacture of forest products, including finishing and fabrication processes, are generally located in major market areas. These industries are often completely independent of the State's forest resources.

The characteristic resource and market orientations of the different manufacturing processes of forest industries are quite evident in their subregional distribution. In 1965, the North Coastal subregion contained 53 percent of the 700 logging establishments in the State, 41 percent of the sawmills and planing mills, and 46 percent of the veneer and plywood plants. However, only 2 percent of the millwork and miscellaneous plants — and no paper and allied products establishments[5] — were located there (table 8). This subregion contained 55 percent of the State's installed sawmill capacity as well as 68 percent of the softwood plywood capacity, 35 percent of the particleboard capacity, and the only hardboard plant in the State (table 9). With the recent completion of two pulpmills, the North Coastal subregion now has 50 percent of the State's installed woodpulping capacity, enhancing its position as California's center of primary forest products manufacture and doubling the State's pulping capacity.

The Sacramento subregion also contains a major concentration of primary forest products manufacturing facilities. In 1965, this subregion had 29 percent of the State's logging establishments and 24 percent of the sawmills and planing mills, but only 10 percent of the millwork plants and less than 2 percent of the paper and allied products establishments. The subregion accounted for 30 percent of the State's sawmill capacity in addition to 16 percent of the softwood plywood capacity, half of the particleboard capacity, and 18 percent of the woodpulping capacity.

Each of the other resource-oriented subregions in California commands smaller concentration of forest industries because of relatively small size. The San Francisco Bay subregion has elements of resource-oriented primary manufacturing but, in addition, is a major market and a center of secondary manufacturing of forest products. In 1965, the subregion contained 14 percent of the State's sawmills and planing mills, 20 percent of the millwork plants, and 28 percent of the paper and allied products establishments. This subregion accounted for only 2 percent of the State's sawmill capacity and 7 percent of its softwood plywood capacity in 1965. However, 53 percent of California's woodpulping capacity was located in the subregion.

The South Coastal subregion contains California's largest market and manufacturing complex and, in addition, is far removed from the important forest resource concentrations in the State. In 1965, this subregion had only 7 percent of the State's sawmills and planing mills, mostly the latter. Although 34 percent of California's plywood plants were located in this subregion, all were manufacturers of hardwood plywood using substantial amounts of material originating outside California. However, the

[5] *This category includes pulpmills. The North Coastal subregion had two pulpmills under construction in 1965, but neither operated for a substantial portion of that year.*

South Coastal subregion accounted for 49 percent of the millwork and miscellaneous wood products plants and 65 percent of the paper and allied products establishments, essentially all concerned with secondary stages of manufacture. Detailed data on the distribution of the forest products industries are in tables 8 and 9 of Appendix A.

Value Added, 1963

In 1963, the value added by manufacture of forest products in the lumber and wood products (SIC[6] 24) and paper and allied products (SIC 26) industries in California totaled $867 million (1963 dollars), 5 percent of the State's total value added (table 10). Thirty-three percent of the value added by the manufacture of forest products was in the South Coastal subregion. The North Coastal (23 percent), San Francisco Bay (19 percent), and Sacramento (13 percent) subregions accounted for most of the remainder of value added in these two sectors for the State.

Almost 90 percent of the value added in the paper and allied products industry was concentrated in the major population and market centers in the South Coastal and San Francisco Bay subregions, where fabrication of paper and board products is centered. Unlike paper and allied products, value added in lumber and wood products is concentrated in the primary wood processing centers in the North Coastal and Sacramento subregions. These two subregions account for 61 percent of California's value added in lumber and wood products. Value added attributable to secondary manufacturing of lumber and wood products is concentrated in the South Coastal and San Francisco Bay subregions.

In 1963, there were five subregions in which the combined forest products industries — SIC 24 and SIC 26 — contributed 10 percent or more to the total value added in manufacturing. The subregions most dependent on the forest products industries were the North Coastal, which derived 92 percent of all value added from forest products, and the North Lahontan, which derived 73 percent. The Sacramento, Delta-Central Sierra, and San Joaquin subregions derived 17, 13, and 10 percent, respectively, from forest products (table 10).

Preliminary data from the 1967 "Census of Manufactures" (U. S. Bureau of the Census 1970) indicate that value added in SIC 24 increased only 5 percent from 1963 to 1967, compared with an increase of 36 percent in value added for all manufactures in California. The subregions that rely substantially on this industrial sector for their economic activity have undoubtedly lagged behind the State in economic growth during the 1963-67 period. Value added in SIC 26 increased 34.5 percent during the same period, reflecting a continuing orientation to markets and their growth.

Employment in the Forest Industries

California's forest industrial employment experienced its most explosive growth period in the 10 years after World War II. During that period, forest industrial employment doubled, culminating at 84,000. Since the mid-1950's, employment in the forest industries (SIC 24 and 26) has remained stable (fig. 9). This stable condition is the product of many offsetting trends among the factors that influence and determine employment. Major among these factors are changes in industrial mix within the forest industrial complex, increase in labor productivity, the constraining effects of resource availability, and market growth.

Generally speaking, forest industrial employment in the resource areas of California has decreased since the mid-1950's, owing to increases in productivity and decreasing availability of raw material. Because of the magnitude of the employment decline in sawmills and planing mills, this downward trend has been only slightly moderated by changes in industrial mix through growth of the plywood, board, and pulp industries. Forest industrial employment in population and market centers has displayed continuous growth in recent years, showing the positive response of secondary manufacturing activities to market growth. These different regional trends have offset each other, resulting in stable employment in the forest industries for the State as a whole.

Employment in lumber and wood products climbed rapidly in the postwar period and

[6] *Standard Industrial Classification — see Definition of Terms in Appendix B.*

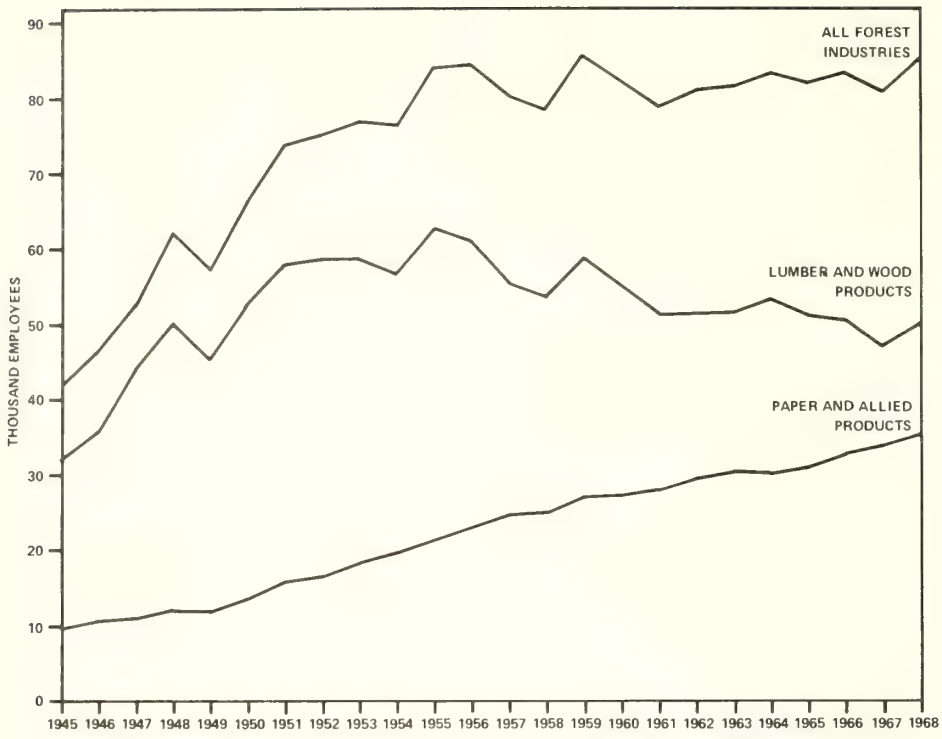

Figure 9. — Average annual employment in California's forest industries, 1945-68. (Source: State of California, Department of Employment; U. S. Department of Labor, Bureau of Labor Statistics.)

peaked in 1955 at slightly over 62,000 — almost twice the 1945 level. By 1968, lumber and wood products employment had dropped 20 percent from the 1955 level (fig. 9). Employment in paper and allied products has climbed continuously since the mid-1940's and by 1968 was 3.5 times the 1945 level of 10,000 (fig. 9). The rapid and continuous employment growth in paper and allied products is closely tied to California's postwar population growth.

Employment in California's lumber and wood products industries totaled 51,000 in base year 1965. Of this total, over 19,000 or 38 percent were employed in the North Coastal subregion, followed by 22 percent in the Sacramento subregion, 17 percent in the South Coastal subregion, and 10 percent in the San Francisco Bay subregion. The remaining 13 percent was distributed among six of the other seven subregions (table 7).

Employment in paper and allied products totaled 30,800 in 1965. Of the total, over 17,000 or 56 percent were located in the South Coastal subregion and 10,000 or 33 percent were in the San Francisco Bay subregion (table 7). The resource subregions had little employment in this sector. The addition of pulping capacity in the North Coastal subregion after 1965 had very little effect on the percentage distribution of paper and allied product employment by subregion.

Nine percent of the lumber and wood products employment in the State was in logging, 46 percent in sawmills and planing mills, 18 percent in millwork plants, 10 percent in plywood and veneer plants, 6 percent in container manufacturing plants, and 11 percent in miscellaneous wood products establishments. In aggregate, 65 percent of the employment was in resource-oriented primary manufacture — logging, sawmilling, and production of softwood plywood and veneer. The remainder was in secondary manufacturing activities that are generally market oriented — millworking, and production of wooden containers and miscellaneous wood products.

Only 25 percent of the employment in paper and allied products was in primary manufacture; 75 percent of the employment was in market-oriented establishments that manufacture converted paper products from purchased or transferred paper stock.

Projected timber supply

The future supply of raw material from California's forests will be determined by the interactions of many factors that will reflect the demands of the State's and Nation's populace. The demand for wood and paper products has traditionally been the most apparent factor, given resource availability. But it is becoming increasingly apparent that there are other demands — often more important than the production of timber products — that must be fulfilled by our timberlands. The State's growing population must be supplied with water and power in increasing amounts, and these commodities have their origins in the State's timbered regions. In addition, demand is increasing for unmarred landscapes and recreational opportunities in the mountain areas. Demand for improved transportation networks is also increasing, and many of these enter and cross the State's timberlands. Many of these demands will involve tradeoffs with timber production on the State's timberlands.

The first part of this section deals with the assumptions underlying the projections of future wood supply from California's timberlands — national and State demand for timber products; population impact on timberland availability; and trends in forest management and wood utilization. The latter part of the section presents projections of future wood production, timber inventories, and growth. Timber inventory and growth were projected for each subregion by use of the stand table projection method, taking into consideration the existing timber resource, related growth rates, trend and plan levels of timber removal by harvesting, anticipated management impacts, and projected inventory loss through reclassification of commercial forest land.

National Demand for Timber Products To Rise

The national demand for timber products was projected to the year 2000 in the report "Timber Trends in the United States" (USDA Forest Service 1965a). A number of factors of economic growth were considered in developing demand projections for roundwood. They included population, household formation, gross national product (GNP), disposable personal income, and construction activity. The Timber Trends study projected an increase in consumption of domestically produced roundwood — from 10.3 billion cubic feet in 1962 to 18.7 billion cubic feet in 2000.

Recent Forest Service projections of national demand for timber products have taken into consideration different assumptions about growth in population, household formations, GNP, dwelling unit construction, and nonresidential construction. For these recent demand projections, population is projected to increase to 308 million by 2000. GNP is projected to rise 4.3 percent annually — to $2,700 billion (1958 dollars) by 2000. Both disposable personal income and expenditures for nonresidential construction are projected to nearly quadruple from 1968 to 2000. And residential construction, which accounts for much of the timber products consumed, is projected to rise from 1.8 million dwelling units in 1968 to 3.5 million units by the year 2000.

With the exception of population (which is lower), the projected levels of these factors are substantially higher than those used in the Timber Trends study. Given the price assumption used in the Timber Trends study — stable prices for primary wood products relative to prices of all commodities — the lower population projection combined with higher projected levels for other economic indicators results in a demand for domestically produced roundwood of 28.2 billion cubic feet by 2000.

A higher wood products price structure, relative to the prices of substitutes, would encourage substitution and lower the quantity of wood products demanded. For the recent Forest Service projections, change in the price assumption to reflect late 1968 prices plus a 1-percent annual increase results in a projected demand for domestic roundwood of 21 billion cubic feet in the year 2000.

California's Share of National Demand To Increase

California differs from the other major timber producers among the Western States in the markets for its forest products. The other Western States have primarily national markets for their forest products. California is the major market for its own forest products. The California markets consume about 60 percent of the State's lumber production (Western Wood Products Association 1969) and a substantial proportion of the softwood plywood production (Zivnuska et al. 1965). The State is also a major importer of lumber, plywood, and woodpulp.

California's population is projected to increase to 38 million by 2000, and to 55 million in 2020, more than tripling the 1965 level of 18 million (fig. 10, table 16). The State's share of

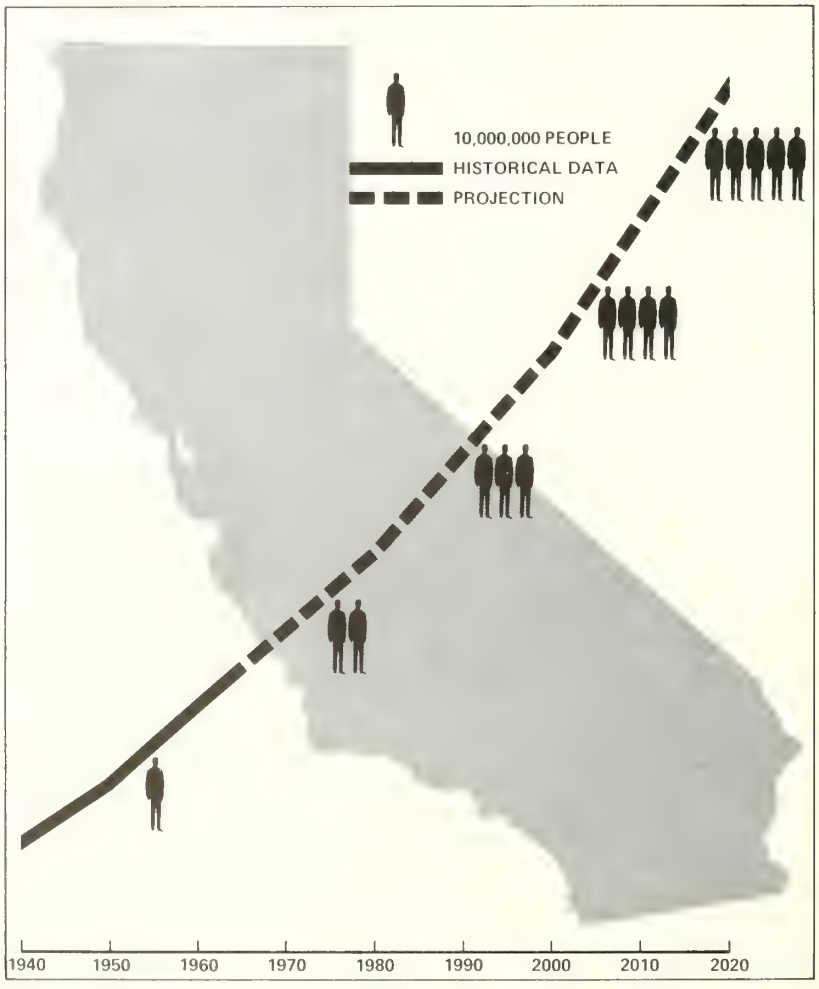

Figure 10. — California population estimates, 1940-2020. (Source: historical data, U. S. Bureau of the Census; projections, Water Resources Council.)

the Nation's population will increase from 9 percent in 1965 to 12 percent in 2000 — and 14 percent by 2020. This projected increase will mean that an increasingly larger share of the Nation's population — and implicitly, a larger share of the other economic factors and national forest-products demand — will be located in California. On the basis of current and projected population distribution and the projected national demand for timber,[7] California's demand for domestic timber should rise from a current level of about 1 billion cubic feet to 3.4 billion cubic feet in 2000. This is a conservative appraisal of the State's share of national demand for forest products, since California has historically accounted for a larger share of the other economic determinants of timber product demand than population would indicate. Given the projected growth in demand for timber products in California and nationwide, the supply limitations imposed by a diminishing resource — which have already had some effect on production levels of wood products — will operate, in the long run, as the major constraints on production levels of forest products derived from California's timberlands.

Population Pressures Will Reduce Forest-Land Base

Population growth in California will result in the conversion of timberlands to other uses. Historically, land clearing for farming, grazing, reservoirs, homesites, and highway and power transmission line rights-of-way have reduced the forested area in the State. Such conversions are expected to continue in the future, resulting in loss of forest acreage, timber inventory, and timber growth.

Local and national demand will result in removal of timberlands, through reclassification, to park and wilderness status, municipal watersheds, recreational subdivisions, and similar single uses. Both public and private lands will be affected. Although physical removal of the timber is not involved in this type of reclassification, the volume and growth, as well as the area, are lost to timber production.

Relative impacts of the various alternative uses of timberlands have changed over time and will continue to do so. Conversions to farm and grazing lands, which have accounted for much of the alternative use to date, will probably diminish. However, reclassification for various types of recreational use seems likely — in keeping with population growth, increases in leisure time and disposable income, and an increased environmental awareness on the part of the public.

Recent Trends in Forest Management and Utilization To Continue

The level of cut to be realized from California's timberlands in the decades to come will be determined by the response of the timberland owners to forest products demand, as reflected in their management and harvesting activities. The supply of raw material available for harvest for most of the plan period — certainly through the end of this century — will come from trees and stands already established. Harvest of private timber will continue to be responsive to demand. On industrial holdings, this response will be tempered by concern for future raw material requirements. Public lands are not as far along in the conversion of old-growth timber as are private lands, and harvesting activities directed at creating regulated forests and protecting multiple use values will continue throughout the plan period.

In projecting California's future timber harvest level, recent trends in forest management and timber utilization are assumed to continue. Fire control and prevention programs should keep acreage burned at current levels, despite the increased hazards associated with heavier recreational use of the State's forests. Progress in salvage of merchantable mortality will continue because of improved accessibility to mortality through extension of the forest road networks. Artificial regeneration after harvest cutting will insure rapid and adequate restocking on public and industrial private ownerships, but little progress is projected for farm and miscellaneous private ownerships.

Increased demand for forest recreation has led public land managers to modify timber harvesting activities in some areas in order to maintain recreational and scenic values throughout

[7] *"Stable price" assumption.*

the growth and harvest cycle. Modified management is also practiced where watershed considerations are of primary importance. Such modified management, which decreases usable growth and yield, will be extended to an increasing acreage of commercial forests in public ownership and will also have some impact on private lands in the future.

In recent years, industry has extended the supply of wood raw material by using more of what has been called cull material, as well as pieces previously left in the woods as logging debris. In addition, more of the previously unused species are gaining acceptability. Industry is expected to continue to make progress in improved utilization of available raw material.

Commercial Forest Area To Decline 5 Percent

California's commercial forest area is projected to decline by 879,000 acres or 5 percent during the period 1965-2020. Over 42 percent of this commercial forest-land loss is projected to occur by 1980, with average annual losses of 25,000 acres. Average annual losses of 9,000 acres and 16,000 acres, respectively, are projected for the periods 1980-2000 and 2000-20 (table 19).

Loss of productive timberland from the unreserved commercial forest base has been assumed to average 16,000 acres annually over the projection period, a continuation of recent trends. In projecting area loss, however, impacts have been varied over time and among the subregions. The allocation of land loss has been varied to reflect anticipated intense pressures for wild-land recreational opportunities and second-home development in the 1970's, and the impact of a population in excess of 40 million people after the year 2000.

Impact of Acreage Loss To Fall on Least Important Resource Subregions

Most of the commercial forest-land losses are expected to occur in the subregions containing, or adjacent to, areas of population concentration. San Francisco Bay, Central Coastal, South Coastal, and Colorado Desert subregions combined have projected losses totaling 534,000 acres by the year 2020 — 61 percent of the loss projected for the State. In 1965, these subregions accounted for less than 5 percent of the State's commercial forest area, sawtimber inventory, and net growth.

The major timber resource subregions of the State will also lose some land to timber production. Water impoundments and road construction will continue in these subregions. These subregions also contain the areas most likely to be reclassified as wilderness. However, their remoteness from the population centers should result in smaller land loss than is anticipated in the timbered areas adjoining population centers.

Private Timber Harvest Decline To Continue

The downward trend in California's timber harvest — which started in the mid-1950's — is projected to continue through the year 2000. Underlying this trend is the decreasing availability of timber from the private sector. California's annual harvest and the harvest from the private sector peaked at the same time; both have since declined. The trend and its projection reflect the decreasing availability of privately held old-growth timber, which until very recently was the mainstay of California's forest industries.

Timber cut on private lands was projected from current levels to future levels with consideration for the availability of mature timber, changing rates of growth, and projected levels of allowable cut on public lands. These projections represent a modification of recent trends in timber harvest on private lands.

Harvesting activities on private land in some areas of the State are shifting into young-growth stands of timber. The impact of decreasing cut of old growth on private lands is anticipated to be moderated by rising harvest levels in young-growth timber. The conversion of privately held old growth will be completed by 2000, and there will be a growth-cut balance on private timberlands, with prospects for small increases in cut over the remainder of the plan period.

Public Timber Harvest Increase To Continue

The timber harvest on public land — which in recent years has risen rapidly, moderating

the effect of the private timber harvest decline — is projected to increase about 15 percent from current levels by 1980. The public timber harvest is then projected to remain at 1980 levels for the remainder of the plan period. This projection does not take into consideration the impacts that could be expected from fertilization, genetic improvement, and other forms of intensified management that might become realities on California's timberlands in the future.

The projected level of cut on public lands — National Forests, State forest, public domain, and Indian trust lands — is based upon each agency's planned allowable cut. The allowable cut is determined by each agency charged with management of public timberlands and is a schedule of annual harvest levels for some specified planning period. For this study, current harvest levels were increased moderately in the early part of the plan period to account for the expected contribution of intermediate cuttings to allowable cut on public lands. Throughout the plan period, most of the harvest from public lands will continue to come from old-growth forests.

Total Timber Harvest Projected To Decline 20 Percent

California's timber harvest, which in 1965 totaled almost 5.3 billion board feet, is projected to decline to 4.4 billion board feet in 1980 and will continue to decline to 4.2 billion board feet by the end of this century. It is anticipated that cutting in the private sector will then be concentrated in young forests and will be based upon growth. Growth is projected to increase on private lands during the period 2000-20, accounting for a projected moderate increase in the harvest in the last period of the projection. The State's harvest is projected to be 4.4 billion board feet in 2020 (fig. 11).

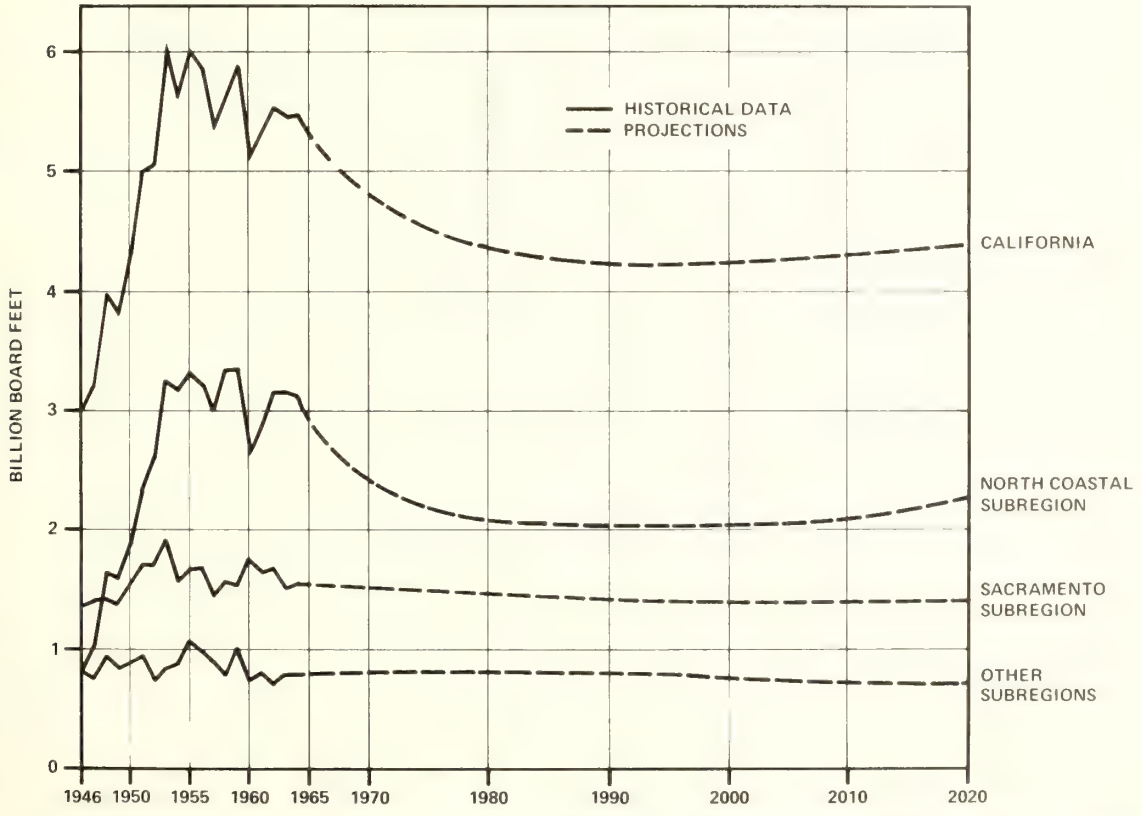

Figure 11. — Recent and projected timber harvest in California and selected subregions, 1946-2020. (Source: historical data, California Division of Forestry; projections, USDA Forest Service (see also table 12).)

Timber Harvest Decline Will Be Concentrated in North Coastal Subregion

In the North Coastal subregion, the timber harvest is projected to decline 29 percent, from 2.9 billion board feet in 1965 to less than 2.1 billion board feet by 2000. This projected decline represents 82 percent of the projected statewide decline in timber harvest, an indication of the concentration of the current private harvest in this subregion. The moderate increase in projected statewide timber harvest in the last 20 years of the period is also concentrated in the North Coastal subregion (fig. 11).

Timber harvest in the Sacramento subregion is projected to decrease from less than 1.6 billion board feet in 1965 to 1.4 billion board feet in 2020, a 10-percent decline. Only the San Joaquin and Tulare subregions have projected increases in timber harvest over current levels. The San Francisco Bay subregion, which in 1965 had a harvest of 148 million board feet, has a projected 85-percent decrease in harvest over the projection period because of anticipated withdrawal of forest lands from timber production.

Sawtimber Inventory To Decrease by 28 Percent

Continued cut in excess of growth and withdrawal of lands from timber production will reduce the State's current 299 billion-board-foot inventory by 28 percent to 214 billion board feet by 2020. Between 1965 and 1980, the average annual inventory decrease will be 2.36 billion board feet; between 1980 and 2020, it will be 1.27 billion board feet. The growing-stock inventory will decline by 8 percent during the 55-year period. The inventory decline is not evenly distributed among the subregions. The North Coastal subregion is projected to experience a 13-percent decline in sawtimber inventory in the next 55 years; the Sacramento subregion, 45 percent. The magnitude of the projected inventory decline in this subregion is due to the current large concentration of old-growth timber, much of which will be removed during the plan period. Inventory decline in other subregions will vary from 12 percent in the North Lahontan to 95 percent in the three southern subregions. The inventory decline projected for the southern subregions is due to anticipated land loss through reclassification (table 20).

Sawtimber Growth To Increase 40 Percent

Net annual growth of sawtimber is projected to increase from current levels of 2.5 billion board feet per year to 3.5 billion board feet annually by 2020, an increase of 36 percent (table 21). When growth is expressed as a percentage of sawtimber inventory, the current growth rate is 0.9 percent; by 2020 it will reach 1.6 percent. The projected increase in the growth rate — and in total growth — is due to the conversion of slow-growing old-growth forests into young, rapidly growing forests.

Growth Increase Concentrated in North Coastal Subregion

In the North Coastal subregion, sawtimber growth will increase from 1,511 million to 2,205 million board feet during the 55-year period, an increase of 46 percent. By 2020, this subregion will account for two-thirds of California's total sawtimber growth. Sawtimber growth will increase 33 percent in the Sacramento subregion and 56 percent in the North Lahontan subregion; only minor changes in growth will occur in the other subregions.

The variation of projected growth responses among the subregions is due to several factors. In the North Coastal subregion, the abundance of second-growth timber on highly productive land will be responsible for the growth increases. The Sacramento subregion and the other subregions in the Sierra Nevada are characterized by relatively large portions of old-growth timber, compared with the North Coastal subregion. And the average productivity of the forest land in these subregions is lower than that of the North Coastal subregion. The large projected increase in sawtimber growth in the North Lahontan subregion is due to the impact of young-growth stocking.

California Will Approach Sawtimber Cut-Growth Balance

In 1965, sawtimber harvest was double the sawtimber growth in California. This reflects

the continued harvesting activities in old-growth sawtimber that still remain in the State, contributing little net growth but supporting large harvests. By 1980, decreasing cut and increasing net growth will result in a cut 46 percent greater than net annual growth. By 2000, the cut will exceed growth by only 25 percent, a relationship that will extend to the end of the plan period. Sawtimber growth and harvest are expected to be in balance on private lands by year 2000. But cutting of old-growth on public lands is assumed to continue through the plan period, accounting for the excess of cut over-growth. The cubic-foot harvest, which exceeded the cubic-foot growth by 37 percent in 1965, will be in balance with growth by 1980 and will remain so for the remainder of the plan period.

The outlook for future forest industrial development

In recent times, California's primary forest products industries have experienced their most active period of growth and diversification. Since the war, both the lumber and plywood industries have experienced rapid growth followed by significant decline. The board industry has grown steadily since the war. And the pulp industry, after a slow start in the 1950's, experienced its most rapid growth in the 1960's. The exporters of logs and chips were significant contenders for raw material in the late 1960's.

The changes in industrial mix and industrial comsumption patterns in recent years, as well as those that will occur in the future, are the result of many factors. The nature of the raw material determines the range of product possibilities, and over time, technology tends to extend the range of those product possibilities. Competition in the market between regional suppliers of like products affects industrial development in each region. Competitive substitution of one wood product for another, or between wood and nonwood products, also helps to shape forest products industrial development.

Not to be overlooked is the availability of raw material. If there is an abundance of raw material, the other factors mentioned determine the industrial mix as well as the scale of industrial development; but if raw material is in short supply, the supply helps to determine the scale of industrial development. Industries that maximize utilization of raw material and value added per unit of input have a competitive advantage over other industries in the raw material market. All of these factors have been and will continue to be operative in determining the industrial consumption pattern in California's forest industries. To the extent possible, all have been considered in projecting the industrial consumption of wood raw material from California's timberlands.

For the purposes of this study, wood exporters and out-of-State shippers (to domestic industry) have been considered consumers of industrial raw material. Although they don't process the raw material locally, the exporters and shippers are a factor in shaping the development of the resident industries. Exports and out-of-State shipments will be discussed under the log consumption and pulpwood consumption headings of this section.

Roundwood Consumption To Decline

Consumption of California-produced roundwood is projected to decline from 883 million cubic feet in 1965 to a low point of 764 million cubic feet in 1980 — a decline of 13 percent (fig. 12). From the 1980 level, it is projected to increase to 829 million cubic feet in 2020. The saw log-veneer log component of roundwood consumption is expected to drop considerably during the projection period. But this drop is offset substantially by projected increases in consumption of roundwood pulpwood, which totaled only 5 million cubic feet in 1965. After little change in 1980, roundwood pulpwood consumption is projected to increase to 84 million cubic feet by 2000 and

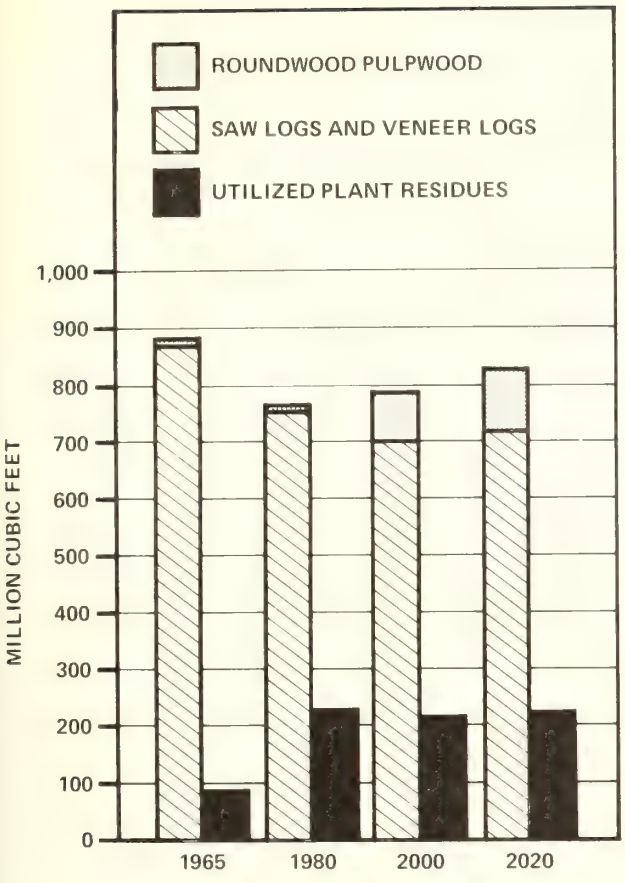

Figure 12. — Estimated wood consumption in California, by type of raw material, 1965-2020.

106 million cubic feet in 2020. By 2020, pulpwood consumption is expected to account for 13 percent of total roundwood consumption.

Much of the roundwood that will be used for pulping is expected to consist of material now considered logging waste and the yields of cultural practices such as thinning. Currently, much of the sound wood that is cut in logging operations is left in the woods. This material will be used for wood and paper products when it becomes economical to do so. As raw material supply continues to diminish, the forest industries are expected to utilize more completely the tree as it is found in the woods. Harvest methods and practices in the recent past have left almost 20 percent of the cubic volume of cut growing stock in the woods.

Residue Consumption To Increase

Consumption of plant residues,[8] excluding use for fuel, is projected to increase from 86 million cubic feet in 1965 to 229 million cubic feet in 1980 — an increase of 166 percent. From 1980 through 2020, residue consumption is expected to remain almost constant, varying between 229 and 219 million cubic feet (table 11). Rapid growth in residue consumption through 1980 is expected as a result of eventual complete utilization of chippable residues and substantial progress in the use of sawdust and shavings. Essentially all chippable residue now used as fuel is expected to be redirected eventually for use by pulp and board industries.

Forest industries have recently made rapid progress in utilization of plant residues. As recently as 1962, only half of the available plant residues from sawmills and plywood plants were used; three-fourths of the residue use was for fuel in generation of power. In 1968, two-thirds of the plant residues were used, and only one-third of the used residues were for fuel.

Even greater use of these residues for raw material is expected to result from increased value of wood for pulp as demand increases for chips for domestic pulping and for export. Adding impetus to increased utilization of residues are impending air pollution controls that will make current burning practices unacceptable as a means of waste disposal. Additional residues should become available for pulping as alternative economical power sources replace wood-fired boilers at some mills.

Log Consumption To Decline 20 Percent

The volume of logs consumed for lumber, plywood, and miscellaneous products is projected to decline from 878 million cubic feet in 1965 to 705 million cubic feet in 2000. A small increase from that level is expected in the last period of the projection.

Consumption by resident industries is expected to drop from 853 million cubic feet in

[8] *Wood residues, excluding bark.*

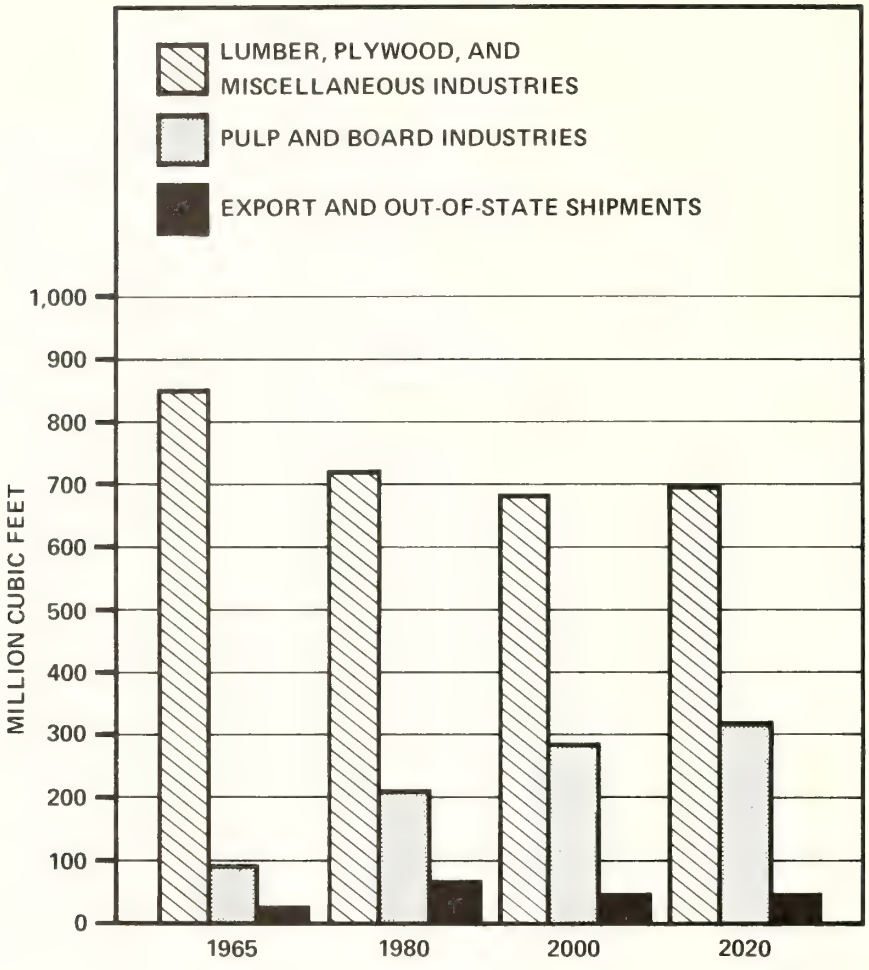

Figure 13. — Estimated wood consumption in California by industry group, 1965-2020.

1965 to 678 million cubic feet by 2000 (fig. 13). The changes in consumption by subregion are expected to be quite variable. For the projection period, the North Coastal subregion has a projected 25-percent decrease in log consumption, but in the Sacramento subregion, the expected decrease is only 11 percent. The Central Coastal and San Francisco Bay subregions have a projected 84-percent decrease in log consumption. Only the Tulare and San Joaquin subregions have projected log consumption increases for the projection period (table 22).

Out-of-State shipment of logs started in the last century. In modern times, such shipments have been a continuous activity, because of the proximity of some California timberlands to wood processing centers in other States. Most of the log shipments originate in the North Coastal subregion and, to a lesser extent, the Sacramento and North Lahontan subregions. Their destination is mainly Oregon, although some are shipped to Nevada. In recent years, these shipments have averaged about 2.5 percent of California's timber harvest, and they are expected to continue at that proportion, declining from 22 million cubic feet in 1965 to 18 million cubic feet in 2020 (table 22).

Offshore export of California logs has recently become an activity of significant magnitude. Only 3 million cubic feet of logs were exported in 1965. However, by 1968, exports had increased to over 42 million cubic feet, about 5 percent of the State's log production for that year. Most of the export logs go to

Japan. The Japanese entry into the wood raw material markets in the State initially took underutilized raw material, primarily young-growth redwood and white woods that had limited local markets because of the availability of old-growth timber. But Japan's basic need for wood raw material is resulting in increased competition with local industry in the log market.

The logs for export have originated primarily on private lands. Recent limitations on export of Federal timber indicate a continuation of that log origin pattern. As timber harvest on private land declines and as local industry progresses further in the transition to a young-growth timber economy, exporters are expected to face stiffer competition in log markets and to look elsewhere for raw material.

Offshore exports of California logs are expected to peak in the early 1970's and, by 1980, are projected to decline to 20 million cubic feet, less than half the 1968 level. Further decline to 10 million cubic feet is projected for the year 2000 and beyond (table 22).

Logs for plywood production have not been separated from those for lumber in this study. The kind of logs used by these two forest products industries is essentially the same. Rapid growth of the plywood industry on the basis of availability of Douglas-fir in the North Coastal subregion has halted. The Douglas-fir segment of the plywood industry will likely decline as supply limitations put pressure on manufacturers who do not own timber resources. A probable combination of pressures in the product markets and short supply of suitable raw material has already served to precipitate some of these operators from the active producer ranks. As a result, veneer consumption is no longer increasing its share of total log consumption. A generally stable relationship between use of logs for plywood and lumber is assumed for the projection period, with veneer logs accounting for about 10 percent of the annual domestic log consumption.

Miscellaneous wood products, including poles, piling, fenceposts, shakes and shingles, box wood, etc., have accounted for a minor and diminishing part of the log harvest in recent times — about 1 percent. Since this trend is expected to continue, consumption for these products has been treated as part of saw-log and veneer log consumption.

Pulpwood Consumption To Increase Sharply

In marked contrast to decline in consumption of logs for lumber and veneer, use of wood for pulping and board production will increase throughout the projection period. The 1965 consumption of wood by pulp and board producers has been estimated at 91 million cubic feet. By 1968, with the addition of two pulpmills and with chip exporting activities, consumption of pulpwood increased to an estimated 155 million cubic feet. The projected pulpwood consumption levels are 236 million cubic feet in 1980, 303 million cubic feet in 2000, and 333 million cubic feet in 2020 (table 23).

By 1967, the Japanese started to import wood chips from California. In 1968, the first full year of export activity, an estimated 14 million cubic feet of chips were exported — 9 percent of the pulpwood produced in California for that year. California's growing woodpulp and board industries are not yet utilizing all of the economically available chippable residues. Export of chips is expected to peak before 1980 and then to decrease as increased capacity in pulpmills and board plants demands most of the chippable residues from wood products manufacturing industries. The Japanese are now importing from California material that was previously burned as unwanted waste. When local demand exceeds the potential supply of unexported chips and when domestic consumers are forced to use roundwood, rising domestic price structures are expected to reduce the amounts of wood chips available for export.

Pulpwood exports — in chip form — are projected at almost 27 million cubic feet in 1980, 11 percent of the projected California pulpwood consumption. By 2000, pulpwood exports are expected to drop to less than 19 million cubic feet, 6 percent of the State's consumption. Exports are expected to stay at that level through the last 20 years of the projection period (table 23).

Pulpwood consumption by resident industries is expected to remain concentrated in the subregions that currently account for most of the consumption. Future location of pulpmills is assumed to depend upon essentially the same criteria that have resulted in the current distribution of the industry. Major among these are adequate wood, water, and transportation.[9]

The North Coastal subregion is projected to increase consumption from 25 million cubic feet in 1965 to 102 million cubic feet in 1980, 123 million cubic feet in 2000, and 150 million cubic feet in 2020 (table 23). This subregion had only one hardboard and two particleboard plants in 1965; it has since added two pulpmills, and a new particleboard plant is under construction. Projected developments include a pulpmill on the coast of Mendocino County by 1980 and a pulpmill in the coastal area of Humboldt-Del Norte Counties between 1980 and 2000. Additional capacity is expected through expansion of existing pulpmills and board plants. Expansion of pulping capacity in the North Coastal subregion is expected to be accompanied by addition of papermaking facilities.

Pulpwood consumption in the Sacramento subregion is projected to increase from 21 million cubic feet in 1965 to 63 million cubic feet in 1980, 81 million cubic feet in 2000, and 84 million cubic feet in 2020. This subregion had two particleboard plants and two pulpmills in 1965. Projected developments include expansion of existing pulping facilities in the northern Sacramento Valley and addition of a large pulp and paper complex in the southern part of the subregion by 1980. An additional pulping facility is projected for this subregion between 1980 and 2000; expansion of particleboard capacity is expected toward the end of the projection period.

The San Francisco subregion, which in 1965 consumed 41 million cubic feet of pulpwood, is expected to experience an increase in consumption to 71 million cubic feet by the year 2000 with the addition of a large pulp and paper facility. There is no projected change for the South Coastal-Colorado Desert subregions, which consume about 4 million cubic feet of raw material annually for pulping and board. Particleboard plants are projected for the San Joaquin and Tulare subregions by 2000.

In summary for the entire State, pulpwood consumption for resident pulpmills is projected to increase from 66 million cubic feet in 1965 to 276 million cubic feet in 2020. Consumption for board plants — both particleboard and hardboard — is projected to increase from 25 million cubic feet to 39 million cubic feet over the projection period. Exports are expected to rise through 1980 and then to decline. Projected pulpmill capacities by subregion are given in table 15 of Appendix A.

[9] *The problem of effluent disposal was not considered as limiting for this study. In absence of technological solutions to air and water pollution problems, the projected pulpmill developments might not be realized.*

Employment trends in the forest products industries

Employment in the forest products industries is a function of levels of production and worker productivity. Technology has resulted in well-established trends of increasing worker productivity at all stages of manufacture in the forest products industries. These trends are expected to continue.

In the long run, levels of production in the resource-oriented areas are tied to the availability of raw material, given market demand for the products. In these areas, the forest products industries are mainly involved in the conversion of raw material into primary products. Logging, lumber and plywood production, and pulp and board production are the manufacturing activities usually located in resource areas. Future trends in forest industrial employment in California's resource-oriented subregions will depend primarily on the timber resource — the raw material supply for the industries.

Levels of production in market areas depend on market demand, which is related to population growth and concentration. California has several population and market centers which have significant concentrations of industries involved in secondary manufacturing of wood and paper products. Future employment trends in the forest products industries in these areas will be dependent upon population growth and related demand. Primary forest products required by the market-oriented secondary manufacturing industries will probably be utilized to the extent that they are available from sources within California. However, lack of locally available raw material will have little impact on the existence and development of secondary forest products manufacture in the population and market centers of the State.

Separate projections of employment in lumber and wood products and paper and allied products were made for each subregion. In the resource subregions whose population projections do not indicate development of major population concentrations, projections of employment are based upon projected availability of raw material and continuation of recent trends in physical productivity. In the market-oriented subregions, employment is projected, based on a continuation of recent regional trends in sector employment-population growth relationships. For subregions that have large population centers or are projected to have large population centers as well as timber resources, employment projections have been made by combining projected resource derived employment with employment projected on the basis of population growth.

Forest Industrial Employment To Increase

California's forest industrial employment, which in 1965 was 82,000, is projected to climb to about 132,000 in 2020, a 61-percent

increase (fig. 14). The gains in employment are expected to be concentrated in the current population centers as well as those projected to develop. The San Francisco Bay, South Coastal, Colorado Desert, and Central Coastal subregions combined have a projected 140-percent increase in forest industrial employment, from 44,000 in 1965 to 105,000 in 2020. All of the increase will be in secondary manufacturing processes, 9,000 in lumber and wood products, and 52,000 in paper and allied products. These four subregions, which in 1965 accounted for 53 percent of California's forest industrial employment, will have 89 percent of such employment in 2020.

Forest Industrial Employment Decline Will Continue in Resource-Oriented Subregions

The North Coastal, Sacramento, Delta-Central Sierra, San Joaquin, North Lahontan, and Tulare subregions will continue to have a substantial part of their forest industrial activity in primary manufacturing processes. In these subregions, forest industrial employment will decline 29 percent between 1965 and 2020 because of substantial declines in employment in lumber and wood products. Of the resource subregions, only the Tulare subregion is projected to have increased employment owing to the anticipated increase in secondary manufacture related to the growth of the Fresno metropolitan area. In the other resource subregions, projected employment declines will range from 7 percent in the San Joaquin to 49 percent in the North Coastal, and 58 percent in the North Lahontan.

Employment in Lumber and Wood Products Industries To Drop 15 Percent by Year 2020

Average annual employment in the lumber and wood products industries was 51,000 in 1965. Projected employment in this sector is 46,800 in 1980, 44,300 in 2000, and 43,400 in 2020 — a 15-percent drop over the 55-year plan period (table 17).

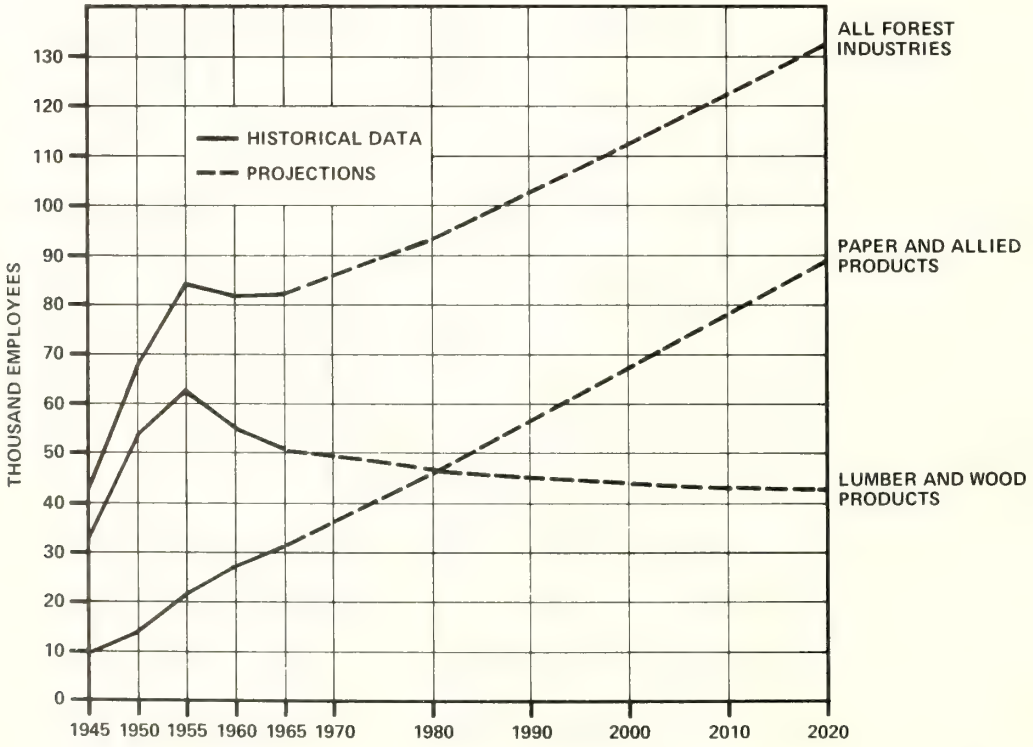

Figure 14. — Recent and projected employment in the forest industries of California, 1945-2020. (Source: historical data, State of California, Department of Employment; U. S. Department of Labor Statistics. Projections by USDA Forest Service.)

Lumber and wood products employment in the North Coastal subregion was 19,400 in 1965, 38 percent of the State's employment in that sector. By 2020, the employment is projected at 7,400, a 62-percent decline. This projected decline is due to a combination of increasing physical productivity and decreased availability of raw material, and it underlines the current and anticipated orientation of the industry in the subregion to primary manufacturing. Lack of major metropolitan market centers, now and prospectively, will forestall the development of substantial secondary manufacturing activities in this subregion.

Employment in the lumber and wood products industries in the Sacramento subregion is projected to drop from 11,300 in 1965 to 7,700 by 2020. This subregion currently has a well-established millworking industry based upon remanufacture of pine lumber for external markets. In addition, the Sacramento County area is a population center on the verge of becoming a major metropolitan area. Thus, the millworking industries that are now manufacturing specialty pine products for national markets will be bolstered by other secondary manufactures for a growing local market. However, increased employment in secondary manufacturing plants is expected to offset only a small portion of the decline in employment in primary wood products manufacture that will occur because of increased productivity and lower production levels.

In the San Joaquin subregion, a projected increase in secondary manufacturing employment does not offset projected decreases in employment in primary wood products manufacturing; a net decrease of 38 percent in lumber and wood products employment from 1965 to 2020 is expected. The Delta-Central Sierra and North Lahontan subregions, without any offsetting increases in secondary manufacturing, have projected decreases in lumber and wood products employment of 55 and 58 percent, respectively, from 1965 to 2020.

The Tulare subregion will experience an increase in primary manufacturing of lumber and wood products in addition to growth in secondary wood products manufacturing associated with the growing Fresno metropolitan area. The result will be an increase in lumber and wood products employment from 1,400 to 2,400 from 1965 to 2020 — an increase of 70 percent. The San Francisco Bay subregion will experience an accelerated decline in employment in the primary phases of lumber and wood products manufacture. But that decline is expected to be more than offset by increases in employment in secondary phases of manufacture. Lumber and wood products employment is projected to rise from 4,900 to 7,500, an increase of 51 percent.

The South Coastal subregion has few plants engaged in primary manufacture of lumber and wood products, but it has a very large secondary manufacturing sector. This subregion has a projected 25-percent increase in lumber and wood products employment — from 8,600 in 1965 to 10,800 in 2020. In the Central Coastal and Colorado Desert subregions, threefold increases in lumber and wood products employment are expected, based upon anticipated population growth in major metropolitan areas.

Employment in Paper and Allied Products Industries To Triple

Employment in paper and allied products in 1965 was 30,800. Employment in this sector is projected to increase to 46,000 in 1980 and 68,000 by the end of the century. The employment projected for the end of the projection period is over 88,000 — an increase of 187 percent over the 1965 level.

Employment in this sector is much more highly aggregated in secondary manufacturing activities and in population centers than is employment in lumber and wood products. Currently, the primary stages of pulp and paper manufacture account for only a very small part of the total SIC 26 employment. Although the capacity of pulp plants is projected to increase severalfold with attendant increases in employment in primary processes, projected increases in secondary manufacture of paper products indicate that paper and allied products employment will continue to be concentrated in highly populated areas. The South Coastal and San Francisco Bay subregions, which now have 88 percent of the SIC 26 employment, will account for the same percentage of the total paper and allied products employment in 2020 (table 18).

Paper and allied products employment in the North Coastal subregion is projected to increase from none in 1965 to 2,500 by 2020. Almost all of the increase is anticipated between 1965 and 1980 and will be in primary pulp and paper manufacturing. The two North Coastal pulpmills, installed since 1965 and now operating, are expected to become integrated pulp and paper manufacturers by 1980. Employment in this sector in the Sacramento subregion is projected to increase from 700 in 1965 to 2,700 in the year 2020 because of increased activity in both primary and secondary stages of manufacture.

In the San Francisco Bay subregion, employment in the paper and allied products industries is projected to increase from 10,000 in 1965 to 35,700 in the year 2020. In the South Coastal subregion, employment in this sector is expected to increase from a 1965 level of 17,000 to 42,000 in 2020. Essentially all of the projected increases in these two subregions will occur in secondary stages of manufacture.

Of the other seven subregions, the five that now have employment in paper and allied products have projected employment increases in that sector. There is no projected entry into primary manufacture of pulp and paper in these subregions because of water or resource limitations. The North Lahontan and South Lahontan subregions, which in 1965 had no employment in paper and allied products, have no projected employment in that sector.

For the State as a whole, employment in paper and allied products — which accounted for 38 percent of forest industrial employment in 1965 — is projected to account for two-thirds of such employment by 2020. Trends in employment in this sector are expected to be the major factor in shifting the concentration of California's forest industrial employment from the resource areas to the population concentration areas.

The recent trends in forest industrial employment, and their projections, indicate that California will experience employment growth in this generalized sector of the economy. But to a major degree that growth will not be dependent on the State's own timber resources. Rather, the increased employment will occur in the secondary, market-oriented stages of manufacture and will be located predominantly in the large population centers. Forest industrial employment in the timber resource areas will decline because of decreasing availability of raw material and increasing physical productivity. The North Coastal and North Lahontan subregions will be hardest hit by the projected declines in employment.

Conclusion

In the early days of statehood, California's economic growth was based in large part upon the development of forest products industries, both as a source of building materials and as a major basic industry. As the State's economy grew and diversified, the forest products industries — which also experienced growth and diversification — became a proportionately smaller contributor to the State's economy. But in some local and regional economies within California, forest products industries still dominate.

California's economy will continue to grow. Population is projected to triple in the next 55 years. Attendant with this growth will be increasing demand for wood products in California as well as nationwide. But self-sufficiency in regional timber resources — which was both possible and necessary in the early development of the State — is no longer possible or necessary. The large areas of old-growth timber on private lands — which have been the mainstay of the forest products industries for over 100 years — have diminished to the point where production of wood products has fallen in face of rising demand. A further decline in log production — to 80 percent of current levels — is anticipated by 2000. Wood products originating out of State, which currently account for a substantial part of the wood products consumed in California, will become increasingly important in meeting the anticipated growth in demand.

Factors other than the availability of old-growth timber will also have an impact on the amount of consumable wood available from California forest lands in the future. Commercial forest-land loss to nontimber uses has helped to shape the current resource. Continued loss of commercial forest land, through conversion or dedication to nontimber uses, will further decrease the commercial forest-land base. Most of the loss will occur in the resource subregions that are adjacent to the centers of population growth.

Better use of timber in both the harvesting and manufacturing processes will make possible a moderate increase in consumption by California's forest products industries in the future. This increase will occur despite a decrease in roundwood harvest from the State's forests. The additional raw material obtained by better utilization will be used primarily by the pulp and board industries because of the nature of the material. Consequently, consumption by these industries will increase, but consumption for lumber and plywood will decrease with the projected decrease in log harvest.

For California, the important aspect of the projected decline in log harvest and changes in the forest industrial consumption patterns is the impact of these factors on some of the regional and local economies within the State. In general, the secondary stages of wood and paper manufacture are concentrated in the

population centers, close to consumer or end-use markets and labor markets. In these areas, employment in wood and paper product manufacturing is tied to population growth and is, to a major degree, independent of the availability of raw material from the State's timber resources. These areas will experience growth in employment in the manufacture of wood and paper products. Although this growth in the secondary stages of wood and paper products manufacture and employment will be substantial, it will continue to make only a small contribution to the overall economic growth of the population centers of California.

The major resource subregions within California are relatively remote from the urban industrial complexes. Their economies depend substantially on the forest industries. Within these subregions are communities whose existence depends upon resident forest industries. The wood-using industries located in these subregions are for the most part concerned with the primary stages of manufacture and are directly dependent on the local timber resource.

Technological development results in a diminishing labor requirement to accomplish each of the steps needed to convert standing trees to finished products. Thus, in absence of an increase in the degree of manufacture of the product or in the amount of raw material processed, employment will decrease over time with constant levels of raw material input. In most of the resource-oriented subregions, projected declines in available raw material will add to the employment decline attributable to increasing productivity.

For those subregions whose major basic industry is dependent upon the forest resource, the implications are clear. The days of economic growth — or stability — through increase or maintenance of timber harvest levels are past. Vertical integration — further manufacture of the basic product — has been proposed as a means for increasing employment within resource regions. It does not seem to be a plausible solution. For much of the product of lumber and plywood plants, no manufacture beyond the primary stage is required before consumption. This is true of most wood used in construction, which in 1962 accounted for over 70 percent of the Nation's lumber and plywood consumption (USDA Forest Service 1965a). Although prefabrication might remove some of the construction process from the building site in the future, the relatively high cost of shipping preassembled components often dictates that prefabrication take place close to the construction site, which means near the market.

The outlook for secondary manufacture of wood and paper consumer products in the resource areas is not favorable. The trend in locational development of secondary manufacturing of wood and paper products — as exhibited in the location of millwork and paper fabricating plants in the market areas — is a manifestation of the economic benefits favoring such location. Finished product manufacture at the market minimizes transportation costs and takes advantage of existing skilled labor markets.

Some gains in employment will accrue in the resource subregions from the increased utilization of residues. Because of the nature of the raw material, these gains will be in the board and pulp and paper industries. But they will offset only slightly the projected employment declines in other sectors of the forest products industries. In summary, future economic growth or maintenance of economic stability in the timber resource subregions of California will be based to a progressively lesser degree upon their timber resources. For those subregions, the trend in timber-based employment is downward. Those subregions must look to diversification to a broader based economy if they are to participate in the future growth and prosperity of California.

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Appendix A

Table 4. — Volume of growing stock on commercial forest land by subregion and owner group, California, 1965

(In million cubic feet)

Subregion	National Forest	Other public	Private	All owners
North Coastal	10,385	1,186	13,468	25,039
Sacramento	10,559	226	6,740	17,525
San Francisco Bay	---	42	986	1,028
Delta-Central Sierra	562	35	537	1,134
San Joaquin	2,930	20	856	3,806
North Lahontan	1,562	41	602	2,205
Central Coastal	34	3	232	269
Tulare	3,140	89	346	3,575
South Lahontan	10	---	5	15
South Coastal	216	([1])	45	261
Colorado Desert	161	---	45	206
All subregions	29,559	1,642	23,862	55,063

Source: USDA Forest Service.

[1] *Less than 500,000 cubic feet.*

Table 5. — Annual log production by subregion, California, 1953-68

(In million board feet[1])

Subregion	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
North Coastal	3,240	3,175	3,309	3,210	2,996	3,338	3,349	2,650	2,892	3,146	3,164	3,141	2,916	2,633	2,756	2,927
Sacramento	1,914	1,564	1,660	1,667	1,455	1,563	1,539	1,751	1,650	1,674	1,510	1,558	1,560	1,624	1,600	1,625
San Francisco Bay	106	155	249	240	230	218	309	238	166	181	201	155	148	106	75	99
Delta-Central Sierra	166	152	147	161	142	138	129	90	166	117	119	91	116	62	96	111
San Joaquin	222	158	220	219	208	182	225	157	197	93	183	193	207	273	256	251
North Lahontan	221	264	264	192	194	82	173	115	134	138	104	142	134	115	77	104
Central Coastal	5	8	21	21	19	36	26	27	28	33	19	24	24	25	29	24
Tulare	109	100	122	135	87	107	112	92	84	139	134	162	146	159	167	202
South Lahontan	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
South Coastal and Colorado Desert	7	24	23	17	16	12	24	16	24	17	27	10	20	11	6	1
All subregions	5,990	5,600	6,015	5,862	5,347	5,676	5,886	5,136	5,341	5,538	5,461	5,476	5,271	5,008	5,062	5,344

Source: California Division of Forestry.

[1] *Scale unspecified.*

Table 6. — Number of sawmills and percent of production by mill size class, California, 1945-68[1]

Capacity[2] and number of mills	1945	1946	1947	1948	1951	1954	1956	1962	1968
Over 25 million board feet:									
Number	21	24	32	40	42	46	61	59	([3])
Percent of production	48	38	43	43	39	40	43	59	([3])
10-25 million board feet:									
Number	37	43	52	55	97	114	130	90	([3])
Percent of production	26	24	23	19	30	34	34	31	([3])
1-10 million board feet:									
Number	154	278	279	351	380	257	304	92	([3])
Percent of production	23	33	29	33	29	22	21	10	([3])
Less than 1 million board feet:									
Number	245	562	521	538	282	187	180	34	([3])
Percent of production	3	5	5	5	2	4	2	--	([3])
All mills:									
Number	457	907	884	984	801	604	675[4]	275[5]	216
Percent of production	100	100	100	100	100	100	100	100	100

Source: USDA Forest Service.

[1] *Data for 1945 through 1951 include Nevada mills, whose contribution is not significant.*

[2] *Based upon rated annual capacity in board feet.*

[3] *Not available.*

[4] *Excludes 20 mills that were not classified as to size.*

[5] *Excludes 22 mills that were not classified as to size.*

Table 7. — Number of forest industry establishments and employees by major industry and subregion, California, 1965

Subregion	Lumber and wood products, SIC 24		Paper and allied products, SIC 26	
	Establishments	Employees	Establishments	Employees
North Coastal	568	19,374	---	---
Sacramento	409	11,328	8	701
San Francisco Bay	313	4,947	135	10,043
Delta-Central Sierra	54	2,095	5	1,095
San Joaquin	53	1,144	5	477
North Lahontan	18	326	---	---
Central Coastal	63	684	5	161
Tulare	86	1,399	4	120
South Lahontan	---	---	---	---
South Coastal	571	8,633	311	17,211
Colorado Desert	57	1,085	7	1,000
All subregions	2,192	51,015	480	30,808

Source: U. S. Bureau of the Census and California Department of Employment.

Table 8. — Number of forest industry establishments by industry group and subregion, California, 1965

Subregion	Logging, SIC 2411	Sawmills and planing mills, SIC 2421	Veneer and plywood plants, SIC 2432	Miscellaneous lumber and wood products, SIC 24 except 2411, 2421, 2432	Paper and allied products, SIC 26
North Coastal	370	153	23	22	([1])
Sacramento	207	88	3	111	8
San Francisco Bay	44	52	4	213	135
Delta-Central Sierra	14	8	1	31	5
San Joaquin	19	14	1	19	5
North Lahontan	9	5	---	4	---
Central Coastal	17	7	---	39	5
Tulare	17	15	---	54	4
South Lahontan	---	---	---	---	---
South Coastal	1	26	17	527	311
Colorado Desert	5	4	1	47	7
All subregions	703	372	50	1,067	480

Source: U. S. Bureau of the Census.

[1] *Two pulpmills were under construction in 1965.*

Table 9. — Capacities of primary wood products processing plants by subregion, California, 1965

Subregion	Sawmills, annual capacity	Softwood plywood plants, annual capacity	Woodpulp mills	Particleboard plants, annual capacity
	Thousand bd. ft.	Million sq. ft., 3/8-inch basis	Tons per 24 hours	Million sq. ft., 3/4-inch basis
North Coastal	3,169,440	979	350[1]	68
Sacramento	1,701,160	230	225	99
San Francisco Bay	131,900	96	675	---
Delta-Central Sierra	106,000	65	---	---
San Joaquin	297,100	60	---	---
North Lahontan	77,800	---	---	---
Central Coastal	44,480	---	---	---
Tulare	193,980	---	---	---
South Lahontan	---	---	---	---
South Coastal	---	---	35	---
Colorado Desert	17,360	---	---	26
All subregions	5,739,220	1,430	1,285	193

Source: USDA Forest Service and various trade journals.

[1] *Hardboard plant.*

Table 10. — Value added by manufacture by selected major industries and by subregion, California, 1963[1]

(In thousand dollars)

Subregion	All manufacturing	Lumber and wood products, SIC 24	Paper and allied products, SIC 26	Total, SIC 24 and 26
North Coastal	220,124	202,958	---	202,958
Sacramento	669,935	102,986	9,192	112,178
San Francisco Bay	3,855,831	41,702	119,973	161,675
Delta-Central Sierra	242,545	18,124	14,077	32,201
San Joaquin	178,902	11,572	6,132	17,704
North Lahontan	6,195	4,496	---	4,496
Central Coastal	210,111	6,882	1,877	8,759
Tulare	327,859	12,452	1,543	13,995
South Lahontan	2,662	---	---	---
South Coastal	10,917,798	90,407	198,769	289,176
Colorado Desert	519,515	11,045	12,342	23,387
All subregions	17,151,477	502,624	363,905	866,529

[1] *These figures are based upon 1963 Census of Manufactures. Lack of census data for some counties necessitated estimates by the author.*

Table 11. — Estimated consumption of roundwood and wood residues by source and use, California, 1965-2020

(In million cubic feet)

Year	Roundwood			Plant residues for pulping and board
	Pulpwood	Saw logs, veneer logs, and miscellaneous	Total	
1965	5	878	883	86
1980	7	757	764	229
2000	84	705	789	219
2020	106	723	829	227

Table 12. — Current and projected log production by subregion, California, 1965-2020 (International 1/4-inch scale)

(In million board feet)

Subregion	1965[1]	1980	2000	2020
North Coastal	2,916	2,094	2,058	2,256
Sacramento	1,560	1,475	1,408	1,400
San Francisco Bay	148	98	46	23
Delta-Central Sierra	116	109	102	95
San Joaquin	207	207	225	230
North Lahontan	134	134	122	120
Central Coastal	24	14	5	5
Tulare	146	237	247	245
South Lahontan	---	---	---	---
South Coastal	7	5	3	1
Colorado Desert	12	10	7	4
All subregions	5,270	4,383	4,223	4,379

[1] *Source: California Division of Forestry.*

Table 13. — Current and projected production of saw logs, veneer logs, and miscellaneous industrial timber products by subregion, California, 1965-2020

(In million cubic feet)

Subregion	1965	1980	2000	2020
North Coastal	472	363	335	360
Sacramento	261	254	236	235
San Francisco Bay	26	18	9	4
Delta-Central Sierra	19	19	19	18
San Joquin	31	35	39	40
North Lahontan	25	23	21	22
Central Coastal	4	2	1	1
Tulare	37	40	43	42
South Lahontan	--	--	--	--
South Coastal	1	1	1	--
Colorado Desert	2	2	1	1
All subregions	878	757	705	723

Table 14. — Current and projected pulpwood[1] production by subregion, California, 1965-2020

(In million cubic feet)

Subregion	1965	1980	2000	2020
North Coastal	46.7	110.0	143.5	163.7
Sacramento	33.0	81.8	111.9	122.3
San Francisco Bay	4.1	7.3	4.9	3.8
Delta-Central Sierra	1.7	5.2	5.6	5.6
San Joaquin	1.7	10.8	14.3	14.3
North Lahontan	--	5.9	4.7	5.9
Central Coastal	1.0	.9	.9	.9
Tulare	.9	11.6	15.0	15.0
South Lahontan	--	--	--	---
South Coastal and Colorado Desert	2.1	2.1	2.1	2.1
All subregions	91.2	235.6	302.9	333.6

Source: USDA Forest Service.

[1] *Includes wood raw material used in the manufacture of hardboard and particleboard, as well as that used in the manufacture of pulp and paper — domestically and otherwise.*

Table 15. — Current and projected capacity of woodpulp mills by subregion, California, 1965-2020

(In tons per 24 hours)

Subregion	1965	1980	2000	2020
North Coastal	350[1]	1,750	2,100	2,500
Sacramento	225	925	1,225	1,225
San Francisco Bay	675	675	1,175	1,175
Delta-Central Sierra	---	---	---	---
San Joaquin	---	---	---	---
North Lahontan	---	---	---	---
Central Coastal	---	---	---	---
Tulare	---	---	---	---
South Lahontan	---	---	---	---
South Coastal	35	35	35	35
Colorado Desert	---	---	---	---
All subregions	1,285	3,385	4,535	4,935

[1] *This capacity is in a hardboard plant. Although hardboard plants are now classified as SIC 24 industries for purposes of reporting employment and value added in manufacture, the capacity is reported here because the raw material requirements and manufacturing processes are similar to those of the woodpulp industry.*

Table 16. — Current and projected population estimates by subregion, California, 1965-2020[1]

(In thousands)

Subregion	1965	1980	2000	2020
North Coastal	208	228	423	879
Sacramento	1,144	1,606	2,855	5,151
San Francisco Bay	4,156	5,926	8,906	12,065
Delta-Central Sierra	286	350	660	1,439
San Joaquin	339	444	783	1,454
North Lahontan	21	27	41	76
Central Coastal	663	976	1,866	3,738
Tulare	958	1,235	2,020	3,697
South Lahontan	14	20	31	41
South Coastal	9,182	12,769	16,957	19,959
Colorado Desert	1,087	1,830	3,577	6,372
All subregions	18,058	25,411	38,119	54,871

[1] *Region totals as provided by Water Resources Council, March 1968. Subregional allocations by the State of California Department of Water Resources.*

Table 17. — Current and projected employment in the lumber and wood products industries by subregion, California, 1965-2020[1]

Subregion	1965	1980	2000	2020
North Coastal	19,374	12,998	9,123	7,408
Sacramento	11,328	10,728	8,636	7,706
San Francisco Bay	4,947	5,478	6,683	7,482
Delta-Central Sierra	2,095	1,753	1,328	953
San Joaquin	1,144	1,081	912	708
North Lahontan	326	251	173	138
Central Coastal	684	1,091	1,628	2,318
Tulare	1,399	1,783	2,033	2,382
South Lahontan	---	---	---	---
South Coastal	8,633	9,905	10,864	10,806
Colorado Desert	1,085	1,692	2,870	3,450
All subregions	51,015	46,760	44,250	43,351

[1] *All employment in SIC code 24, as defined by the U. S. Bureau of the Census.*

Table 18. — Current and projected employment in paper and allied products industries by subregion, California, 1965-2020[1]

Subregion	1965	1980	2000	2020
North Coastal	0	2,450	2,500	2,525
Sacramento	701	2,110	2,755	2,725
San Francisco Bay	10,043	12,455	23,530	35,715
Delta-Central Sierra	1,095	1,085	1,145	1,245
San Joaquin	477	500	750	800
North Lahontan	---	---	---	---
Central Coastal	161	200	250	400
Tulare	120	220	320	520
South Lahontan	---	---	---	---
South Coastal	17,211	25,420	34,780	42,060
Colorado Desert	1,000	1,480	2,020	2,440
All subregions	30,808	45,920	68,050	88,430

[1] *All employment in SIC code 26, as defined by the U. S. Bureau of the Census.*

Table 19. — Estimated area of commercial forest land by subregion, California, 1965-2020

(In thousand acres)

Subregion	1965	1980	2000	2020
North Coastal	7,156	7,121	7,091	7,061
Sacramento	6,249	6,200	6,150	6,100
San Francisco Bay	418	370	300	200
Delta-Central Sierra	382	370	350	320
San Joaquin	916	915	910	900
North Lahontan	1,055	1,050	1,050	1,050
Central Coastal	152	80	80	50
Tulare	771	765	765	760
South Lahontan	7	---	---	---
South Coastal	103	50	50	---
Colorado Desert	136	50	50	25
All subregions	17,345	16,971	16,796	16,466

Source: USDA Forest Service.

Table 20. — Projected inventory of growing stock and sawtimber on commercial forest land by subregion, California, 1965-2020

Subregion	Growing stock				Sawtimber (International 1/4-inch scale)			
	1965	1980	2000	2020	1965	1980	2000	2020
	------- Million cubic feet -------				------- Million board feet -------			
North Coastal	25,039	25,569	26,489	27,659	132,089	119,623	115,590	114,289
Sacramento	17,525	15,854	14,168	12,622	98,523	84,266	68,787	54,146
San Francisco Bay and Central Coastal	1,297	1,167	1,298	1,240	7,033	5,486	6,208	5,997
Delta-Central Sierra and San Joaquin	4,940	4,829	4,290	4,009	27,746	25,265	21,890	18,311
North Lahontan	2,205	2,146	2,290	2,633	11,094	10,225	9,758	9,772
Tulare	3,575	3,280	2,941	2,633	19,784	17,687	14,900	11,823
South Lahontan, South Coastal, and Colorado Desert	482	200	198	31	2,795	1,140	1,082	152
All subregions	55,063	53,045	51,674	50,827	299,064	263,692	238,215	214,490

Source: USDA Forest Service.

Table 21. — Trend of net annual growth of growing stock and sawtimber on commercial forest land by subregion, California, 1965-2020

Subregion	Growing Stock				Sawtimber (International 1/4-inch scale)			
	1965	1980	2000	2020	1965	1980	2000	2020
	- - - Million cubic feet - - -				- - - Million board feet - - -			
North Coastal	405	460	448	461	1,511	1,805	2,015	2,205
Sacramento	137	160	188	171	586	713	824	780
San Francisco Bay and Central Coastal	30	31	33	25	114	130	155	118
Delta-Central Sierra and San Joaquin	31	34	35	29	150	162	166	144
North Lahontan	19	24	33	35	81	93	112	126
Tulare	19	21	21	19	96	101	101	88
South Lahontan, South Coastal, and Colorado Desert	1	---	---	---	7	3	3	---
All subregions	642	730	758	740	2,545	3,007	3,376	3,461

Source: USDA Forest Service.

Table 22. — Estimated consumption of saw logs, veneer logs, and miscellaneous industrial timber products produced in California by subregion, 1965-2020

(In million cubic feet)

Subregions	1965	1980	2000	2020
North Coastal	464	344	325	350
Sacramento	246	237	220	218
San Francisco Bay	26	18	9	4
Delta-Central Sierra	18	17	17	16
San Joaquin	40	43	49	49
North Lahontan	11	10	9	10
Central Coastal	6	3	1	1
Tulare	40	44	47	46
South Lahontan	---	---	---	---
South Coastal and Colorado Desert	2	2	1	1
All subregions	853	718	678	695
Foreign export	3	20	10	10
Out-of-State shipments	22	19	17	18
Total consumption	878	757	705	723

Source: USDA Forest Service.

Table 23. — Estimated pulpwood consumption by subregion, California, 1965-2020[1]

(In million cubic feet)

Subregion	1965	1980	2000	2020
North Coastal	25.1	101.5	122.6	149.7
Sacramento	20.7	62.9	80.9	83.9
San Francisco Bay	40.6	40.6	70.7	70.7
Delta-Central Sierra	---	---	---	---
San Joaquin	---	---	3.0	3.0
North Lahontan	---	---	---	---
Central Coastal	---	---	---	---
Tulare	---	---	3.0	3.0
South Lahontan	---	---	---	---
South Coastal and Colorado Desert	4.2	4.2	4.2	4.2
All subregions	90.6	209.2	284.4	314.5
Foreign export	---	26.8	18.6	18.5
Total consumption[2]	90.6	236.0	303.0	333.0

Source: USDA Forest Service.

[1] *Includes wood raw material used in the manufacture of hardboard and particleboard, as well as that used in the manufacture of pulp and paper — domestically and otherwise.*

[2] *Totals do not agree with those in table 14 because of rounding errors.*

Appendix B

Definition of terms

Allowable cut. — The volume of timber that may be cut during a given period under specified management plans for sustained production, such as those in effect on National Forests.

Commerical forest land. — Forest land that is capable of producing crops of industrial wood and is not withdrawn from timber use by statute or administrative regulation; includes areas suitable for management to grow crops of industrial wood and generally capable of producing in excess of 20 cubic feet per acre of annual growth; includes both accessible and prospectively accessible areas and both operable and prospectively operable areas.

Commercial species. — Tree species now or prospectively suitable for industrial wood products; excludes so-called weed species.

Cull trees, — Live trees that do not contain at least one merchantable saw log, now or prospectively, because of roughness, rot, or species.

Diameter classes. — A classification of trees based on diameter of the tree outside bark, measured at breast height (4½ feet above the ground). D.b.h. is the common abbreviation for "diameter at breast height."

Employment. — The estimated number of all production and nonproduction workers in the appropriate SIC code or specially defined occupational category.

Farmer-owned lands. — Lands owned by operators of farms.

Forest industry lands. — Lands owned by companies or individuals operating wood-using plants.

Forest land. — Land at least 10 percent stocked by forest trees of any size, or formerly having had such tree cover and not now developed for nonforest use; includes chaparral areas in the West and afforested areas. The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width at least 120 feet wide to qualify as forest land. Unimproved roads and trails, streams, and clearings in forest areas are classed as forest if less than 120 feet in width. (See also commerical, noncommercial, productive-reserved, and unproductive forest lands.)

Forest management. — The protection and management of forest lands for the production of timber and related products.

Forest products industries. — See timber products industries.

Forest types. — A classification of forest land based upon the tree species now forming most of stocking. Where no species com-

prises a majority of a stand, types are based on plurality of stocking.

Growing-stock trees. — Live sawtimber trees. poletimber trees, saplings, and seedlings of commercial species meeting specified standards of quality or vigor that are now or may be expected to become suitable for use as industrial wood; excludes cull trees.

Growing-stock volume. — Net volume in cubic feet of growing-stock trees 5.0-inch d.b.h. and over from a 1-foot stump to a minimum 4.0-inch top diameter outside bark at the central stem or to a point where the central stem breaks into limbs.

Hardwoods. — Dicotyledonous trees, usually broad-leaved and deciduous.

Industrial wood. — All commerical roundwood products, such as saw logs and pulpwood but excluding fuelwood and posts.

Land area. — (a) Census definition — the area of dry land and land temporarily or partially covered by water, such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide); streams, sloughs, estuaries, and canals less than one-eighth of a statute mile in width; and lakes, reservoirs, and ponds less than 40 acres in area. (b) Forest Survey definition — same as above except maximum width of streams, etc., is 120 feet, and maximum size of lakes, etc., is 1 acre.

Logging residues. — The unused portions of poletimber and sawtimber trees cut or killed by harvesting timber, land clearing, or cultural operations.

Miscellaneous private lands. — Privately owned lands other than forest industry or farmer-owned lands.

Mortality. — The volume of sound wood in live sawtimber and poletimber trees (growing-stock trees) dying from natural causes during a specified period.

National Forest land. — Federal lands that have been designated by Executive Order or statute as National Forests or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones Title III lands.

Net annual growth. — The average annual change in volume of sound wood in live sawtimber and poletimber trees resulting from natural causes, i.e., increase in volume in absence of mortality and cutting, minus mortality, plus growth on mortality and growth on one-half the cut during a specified period.

Net volume. — Gross volume less deductions for rot, sweep, or other defects affecting use for timber products.

Noncommercial forest land. — Unproductive forest land incapable of yeilding crops of industrial wood because of adverse site conditions, and productive forest land withdrawn from commerical timber use through statute or administrative regulation.

Nonforest land. — Land that has never supported forests and lands formerly forested but now developed for such nonforest uses as crops, improved pasture, residential areas, and city parks, improved roads, and adjoining rights-of-way, powerline clearings, and certain areas of water classified by the Bureau of the Census as land (see definition of land area). In forest areas, unimproved roads, streams, canals, and nonforest strips must be more than 120 feet wide; and clearings in forest areas must be more than 1 acre in size, to qualify as nonforest land.

Nonstocked areas. — Commerical forest land less than 10 percent stocked with growing-stock trees.

Old-growth sawtimber stands. — Sawtimber stands in which 50 percent or more of the net board-foot volume is in old-growth sawtimber trees.

Old-growth sawtimber trees. — Trees that have reached or passed the age of physiological maturity.

Other public lands. — Federal lands other than National Forests, such as lands administered by the Bureau of Land Management, and Indian lands; State, county, and municipal lands.

Ownership. — The property owned by one owner, including all such parcels of land in the United States.

Plant residues. — Wood materials from primary manufacturing plants that are not used for some product.

Poletimber stands. — Stands at least 10 percent stocked with growing-stock trees, and with poletimber trees making up a plurality of this stocking.

Poletimber trees. — Live trees of commercial species 5.0 to 10.9 inches in diameter at breast height, and of good form and vigor.

Productive-reserved forest land. — Productive public forest land withdrawn from timber use through statute or administrative regulation.

Projected demand. — The estimated quantity of a roundwood product, or products, that would be demanded at specified times in the future under explicit assumptions as to (1) the growth of population and gross national product (GNP), (2) trends in the use of materials, and (3) trends in the prices of timber products relative to substitute materials.

Projected employment. — The estimated employment that would be associated with meeting projected demands for a timber product or products at specified times in the future under explicit assumptions or as to (1) changes in productivity; i.e., output per employee, (2) changes in level of production, and (3) changes in structure of the industry.

Raw material. — In the forest products industries, the wood fiber material used as the basic input in primary manufacturing processes. Includes roundwood, and byproducts such as residues used for fuel or pulping.

Roundwood products. — Logs, bolts, or other round sections cut from trees.

Saw-log. — A log meeting minimum approved log-grade specifications; or, for species for which approved log grades are lacking, a log at least 10 feet long, with a minimum d.i.b. of 10 inches, and with a net scale of at least 30 board feet.

Saw-log portion. — That part of the bole of sawtimber trees between the stump and the saw-log top.

Sawtimber stands. — Stands at least 10 percent stocked with growing-stock trees, and with sawtimber trees making up a plurality of this stocking.

Sawtimber trees. — Live trees, 11.0 inches or larger in diameter at breast height, containing at least one minimum saw-log.

Sawtimber volume. — Net volume of the saw-log portion of live sawtimber in board feet, International ¼-inch scale.

Softwoods. — Coniferous trees, usually evergreen, having needles or scalelike leaves.

Standard Industrial Classification (SIC). — A classification of establishments by type of activity in which engaged. An "establishment" is an economic unit which produces goods or services.

Stocking. — A measure of the degree to which area is occupied or used by trees of specified classes, including (a) all live trees, (b) growing-stock trees, and (c) desirable trees. Classification of forest land and forest types is based on stocking of all live trees. Stocking of growing-stock trees is used to determine stand-size and age class.

Stocking standards. — The minimum number of well-spaced trees required to use fully the area by specified forest types and sites.

Timber cut from growing stock. — The volume of sound wood in live sawtimber and poletimber trees cut for forest products during a specified period, including both roundwood products and logging residues.

Timber cut from sawtimber. — The net board-foot volume of live sawtimber trees cut for forest products during a specified period, including both roundwood products and logging residues.

Timber products. — Roundwood products and

byproducts of primary wood manfacturing plants; includes saw logs, veneer logs and bolts, cooperage logs and bolts, pulpwood, fuelwood, piling, poles, posts, hewn ties, mine timbers, and other round, split, or hewn products.

Timber products industries. — Industries included in Major Group 24, Lumber and Wood Products, Except Furniture; and Major Group 26, Paper and Allied Products, described in the "Standard Industrial Classification Manual" (Bureau of the Budget 1967). The major industries are:

Logging. — (SIC 2411) Logging camps and logging contractors primarily engaged in cutting timber and in producing rough, round primary forest or wood raw materials.

Sawmills and planing mills. — (SIC 2421) Establishments primarily engaged in sawing rough lumber and timber from logs and bolts, or resawing cants and flitches into lumber, including box lumber, and softwood cut stock; planing mills combined with sawmills; and separately operated planing mills which are engaged primarily in producing surfaced lumber and standard workings or patterns lumber.

Veneer and plywood plants. — (SIC 2432) Establishments primarily engaged in producing commercial veneer, either face or technical, and those primarily engaged in manufacturing commercial plywood, including nonwood backed or faced veneer and nonwood faced plywood, from veneer produced in the same establishment or from purchased veneer.

Paper and allied products. — (SIC 26) Establishments primarily engaged in the manufacturing of pulps from wood and other cellulose fibers and rags; the manufacture of paper and paperboard; and the manufacture of paper and paperboard into converted products such as paper coated off the paper machine, paper bags, paper boxes, and envelopes.

Miscellaneous wood manufacturing. — (All SIC 24 categories except 2411, 2421, 2432) Employment reported for several other SIC divisions within Major Group 24 were combined as miscellaneous wood manufacturing. The group includes hardwood dimension mills, shingle mills, millwork plants, prefabricated structures, wooden containers, and wood preserving. Industries in this group are either secondary manufacturers or they process a small amount of the total log harvest.

Unproductive forest land. — Forest land incapable of yielding crops of industrial wood because of adverse site conditions; includes sterile or poorly drained forest land, subalpine forests, and steep, rocky areas where topographic conditions are likely to prevent management for timber production.

Value added by manufacture. — Adjusted value added is obtained by subtracting cost of materials, supplies and containers, fuel, purchased electric energy, and contract work from value of shipments for products manufactured, plus receipts for services rendered and other receipts such as the sale of scrap. It also includes (1) value added by merchandising operations (i.e., the difference between the sale value and cost of merchandise sold without further manufacture, processing, or assembly), plus (2) the net change in finished goods and work-in-process inventories between the beginning and end of the year (U. S. Bureau of the Census 1966b).

Young-growth sawtimber stands. — Sawtimber stands in which 50 percent or more of the net board-foot volume is in young-growth sawtimber trees.

Young-growth sawtimber trees. — Trees that have not passed the age of physiological maturity.

The mission of the PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION is to provide the knowledge, technology, and alternatives for present and future protection, management, and use of forest, range, and related environments.

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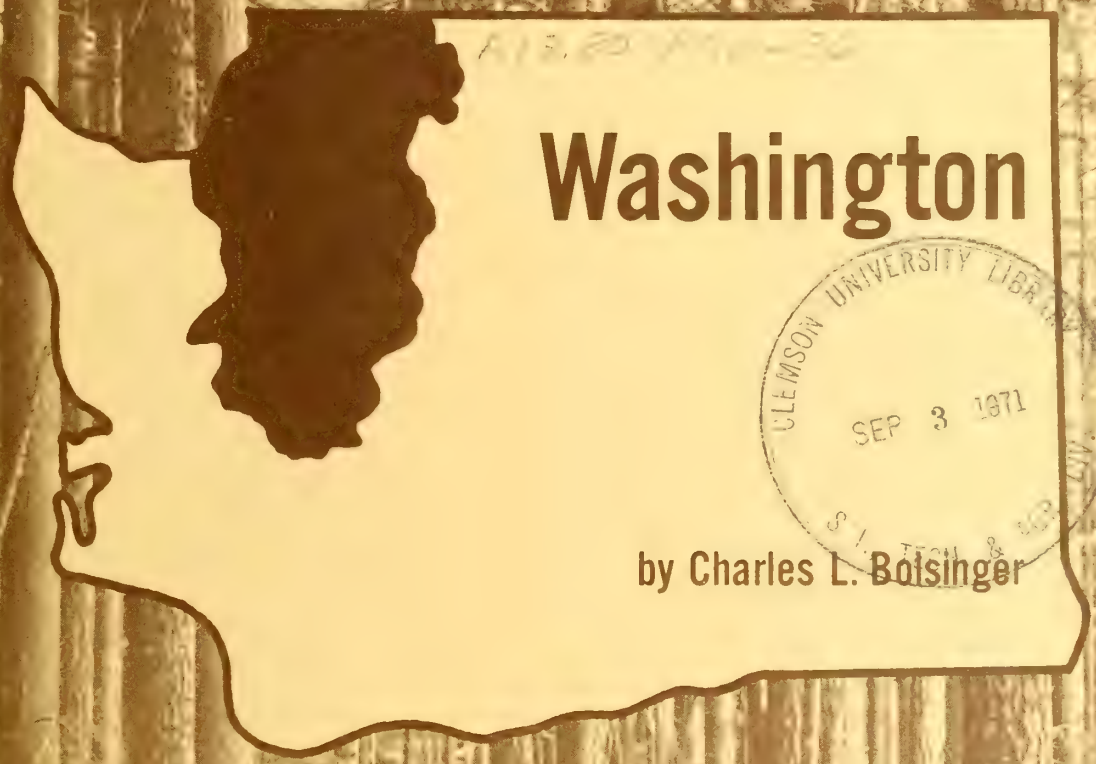
Timber Resources of the Puget Sound Area



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Many public agencies, including some of those mentioned above, and several private timber companies provided maps and helpful information on access to forest lands, as well as general information on land use trends, forest management activities, and current and potential problems related to forest management in the Puget Sound area.

Mr. Robert W. Cowlin, former Director of the Pacific Northwest Forest and Range Experiment Station, provided background information on the economic development of the Puget Sound area.

PREFACE

This report summarizes the findings of the latest inventory of the forests in Island, King, Kitsap, Pierce, San Juan, Skagit, Snohomish, and Whatcom Counties, Washington. Fieldwork on lands outside the National Forests was started in 1966 and completed in 1967. Data from the 1960 inventory were used for San Juan County in this report. Fieldwork on the north half of the Mount Baker National Forest was done in 1965; the south half was done in 1966. The portion of the Snoqualmie National Forest in the Puget Sound area was inventoried in 1964 and 1965, with the exception of the Cedar River Block which was inventoried in 1961. Inventories previous to the above were completed as follows:

County	First inventory	Second inventory	Third inventory
Island	1932	1959	—
King	1932-33	1941	1960
Kitsap	1933	1940	1959
Pierce	1932-33	1938	1959
San Juan	1932	1960	—
Skagit	1931-32	1957	—
Snohomish	1932	1955	—
Whatcom	1931-32	1957	—

This inventory was conducted by the Forest Survey, a nationwide project of the Forest Service authorized by the McSweeney-McNary Forest Research Act of 1928 and subsequent amendments. The purposes of the Forest Survey are (1) to obtain comprehensive information on timber resources, including the extent and condition of forest lands, the amount and kind of timber growing on these lands, the rate of forest growth and depletion, the amount of timber cut, and probable future trends in timber requirements, and (2) to analyze and make available survey information needed to formulate forest policies and programs. Resurveys are made periodically to update basic information.

The Forest Survey is conducted in all nine forest regions of the United States by the USDA Forest Service Experiment Stations. The Pacific Northwest Forest and Range Experiment Station at Portland, Oregon, is responsible for the States of Washington, Oregon, California, Alaska, and Hawaii.

SUMMARY

The latest inventory of the forest resources in the Puget Sound area shows a total of 3,300,000 acres of commercial forest land and 74,859 million board feet (International ¼-inch scale) of sawtimber volume. Since 1953, about 221,000 acres of commercial forest land have been converted to roads, powerlines, reservoirs, agriculture, and urban and industrial developments, and about 65,000 acres have been set aside in parks and other reserved areas. Total sawtimber volume has decreased about 8 percent; softwoods have decreased 11 percent, while hardwoods have increased 71 percent.

About 41 percent of the commercial forest land is in public ownership; 59 percent is private, with forest industries holding 28 percent and farmers and miscellaneous private owners, 31 percent. About 20 percent of the commercial forest land is in old-growth timber, and over half of this is in National Forest ownership. Other public owners have 13 percent of the old growth; forest industries, 28 percent; farmers and miscellaneous private owners, 8 percent.

Douglas-fir is the most extensive forest type* but is estimated to cover only half as much area as it covered in the 1800's before settlement of the Puget Sound area. Over 600,000 acres of logged and burned country now stocked with hardwoods, and many agricultural areas, roads, reservoirs, and town and industrial sites were once Douglas-fir forest. Almost 60 percent of the Douglas-fir type is in private ownership. Western hemlock is the second most extensive forest type and the major type on National Forest lands.

Less than 2 percent of the forest land is nonstocked, a contrast with conditions in 1933 when about 20 percent was nonstocked. This improvement reflects the success of fire control and forestry efforts since the 1930's but is probably more a testimony to the recuperative ability of the forest land in the Puget Sound area. In spite of this improvement in stocking, large areas are occupied by low quality trees. Hardwood types are predominantly in private ownership and cover a greater area than the total commercial forest land on the National Forests; hundreds of thousands of acres now stocked with hardwoods formerly supported more valuable conifers.

Sixty percent of the commercial forest land is capable of growing 120 or more cubic feet per acre per year. In general, the best tree-growing lands are in the mid-elevations, which are predominantly in State and forest-industry ownership. National Forests and farmer and miscellaneous private owners hold much of the lower quality forest land.

Though Douglas-fir is the most extensive forest type, there is more western hemlock volume — 24 billion board feet of hemlock compared with 21 billion Douglas-fir. This is because much more of the Douglas-fir type is young growth with less volume per acre.

Net annual growth is about 1.4 billion board feet, somewhat less than current annual timber harvest. Over the years, the timber cut has shifted from private to public lands and from Douglas-fir to hemlock. Annual mortality averages 130 board feet per acre and is highest on National Forest and forest-industry lands, which include about 80 percent of the old-growth timber. Hemlock accounts for one-third of the mortality and true firs for one-fifth. About 15 percent of the mortality is Douglas-fir.

The low country between the foothills of the Cascades and Puget Sound is rapidly being urbanized and industrialized. The Washington State Department of Natural Resources has classified State-owned lands into resource zones for the present, for 1980, and for 2000. Though applicable only to State lands, the projections were based on expected uses of all lands, using past trends as a guide. Within the Department's Year 2000 Urban Zone in the Puget Sound area are an estimated 1,154,000 acres of commercial forest land, about 35 percent of the total in the eight counties, and 11 percent of the total in western Washington. Included are nearly half on the Douglas-fir acreage and 43 percent of all young-growth stands in the Puget Sound area. If these lands are converted to nonforest uses, total potential production of timber may be reduced by 30 percent.

**Definitions of technical terms are found beginning on page 67.*

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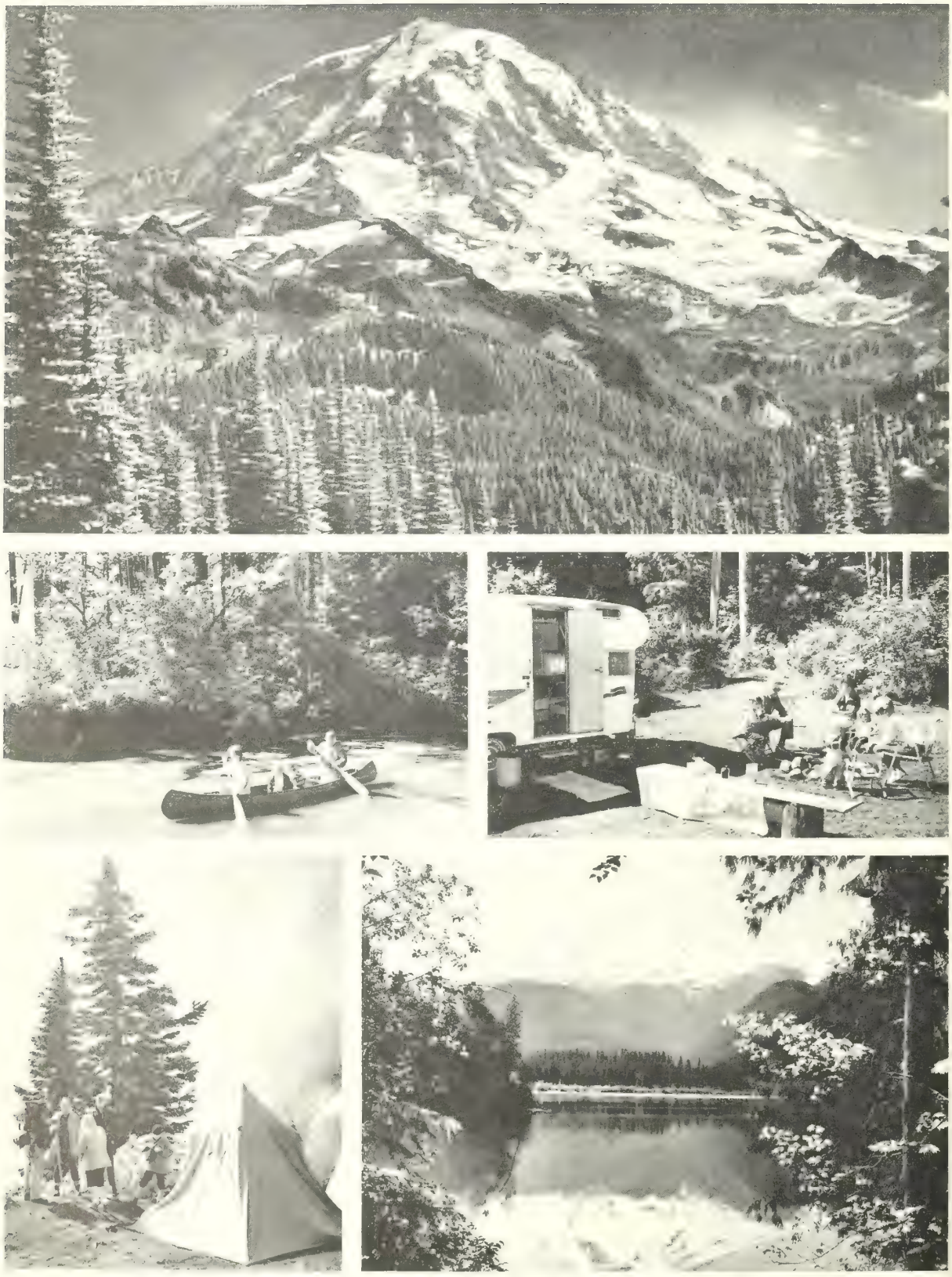

Figure 1. — The Puget Sound country has been called "The Charmed Land."

INTRODUCTION

This report is concerned with the timber resources of eight counties in western Washington — Island, King, Kitsap, Pierce, San Juan, Skagit, Snohomish, and Whatcom. Island and San Juan Counties consist of several islands in Puget Sound. Kitsap County is basically a peninsula connected to the larger Olympic Peninsula west of the Sound. The remaining five counties are on the mainland. Their western limits form the east shore of Puget Sound; their eastern limits follow the crest of the Cascade Mountains. Mount Rainier, in Pierce County, marks the south end of the area; Mount Baker, in Whatcom County near the Canadian line, marks the north end (fig. 1).

The eight counties make up about 16 percent of the total land area in the State but have 62 percent of the State's population. Several of the State's larger cities are in this area, including Seattle, Tacoma, Bremerton, Everett, and Bellingham. The average population density is about 190 persons per square mile, but even in the most populous counties there are extensive areas of sparsely populated land. In general the population is concentrated along the Sound and in the river valleys. Many mountain areas are completely without permanent residents.

Forests form the dominant natural vegetative cover over most of this area, extending from sea level to timberline which ranges from about 5,000 to 6,000 feet in elevation. The forests have been and still are one of the area's most important resources.

The forest resource data presented in this report and the discussions of forest area, volume, growth, and cut relate to the supply of wood available to meet regional and national needs. The information in this report is presented for the use of legislators, local and regional planners, investors, forest industry managers, and others interested in the timber situation.[1] Some of the information in this report — the discussion of forest land losses and the supporting data, for example — may be useful to people who are not interested in timber production but are concerned about the changes taking place in the Puget Sound landscape.

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[1] *Besides timber, several other products are harvested from commercial forest lands in the Puget Sound area and sold on the market. The floral greenery industry provides full- and part-time work for hundreds of people. In 1969, about $540,000 worth of evergreen huckleberry, salal, swordfern, Oregongrape, and Scotch broom were gathered and sold in the eight counties. Other products include cascara bark, fuelwood, small roundwood for posts, cabin logs, flatcar stakes, mine props and hop poles, and forest seed cones (Douglass 1970).*

Information on recreation, watershed, and other uses of forest land is available from the Pacific Northwest Forest and Range Experiment Station.

BACKGROUND

About 125 years ago, a few settlers established homes at Fort Nisqually, a Hudson's Bay Company trading post near the south end of Puget Sound. These early settlers found tall, dense evergreen forests reaching from salt water to the mountains. The only natural openings were lakes, bogs, stream beds, and a few gravelly prairies. The settlers started to clear the land for farming and to obtain material for building their homes. Though much of the land near Puget Sound was flat enough to farm, the soils in most areas were gravelly and did not prove suitable for agriculture, despite the lush forest vegetation they supported. Only the river valleys produced a return for the farmers' efforts. Many pioneers who came to the Puget Sound country to farm became loggers.

In 1847, the year before Oregon (which then included what is now Washington State) was admitted by Congress as a territory, a sawmill was built at Tumwater, near present-day Olympia. In 1850-51, a settlement was established at Alki Point, the beginning of Seattle. The 1849 gold rush created lumber needs in California, and, in response to this and local needs, Henry Yesler built a steam sawmill in Seattle in 1852 which cut about 15,000 board feet a day. In 1853, Captain Andrew Talbot, originally from Maine, built a sawmill at Port Gamble near the confluence of Hood Canal and Puget Sound in what is now Kitsap County. This was the beginning of the Pope and Talbot Company in the Pacific Northwest, which still exists today with a mill operating at its original location in Port Gamble. A sawmill was also established in 1853 by Captain Henry Roeder on Bellingham Bay in what is now Whatcom County. By 1854, about three dozen sawmills on the Sound were producing lumber and loggers were felling trees — Douglas-fir, western redcedar, and some Sitka spruce — near tidewater and yarding the enormous logs by ox team. Lumbering became the principal industry, though the market was limited to the west coast and Sandwich Islands (Hawaii) until the transcontinental railroads reached Seattle (1889 to 1909) and the Panama Canal was opened in 1914.

Three major railroads tapped the Puget Sound area, and they were important to the timber industry in that they expanded lumber markets and one of them was granted vast tracts of forest land, some of which later became large timber company holdings. Some of these early grant lands are still in railroad company ownership and are intermingled with National Forest lands in a broad checkerboard pattern.

Lumbering increased and the forests were logged off in the lowlands near the Sound, up the fingerlike river valleys, and on the foothills west of the high mountains. Thousands of acres of timber were claimed by fires during this same period, and many cutover areas burned two, three, or more times. More settlers tried to farm the cutovers, and "stump ranches" appeared througout the low hills near the Sound. In time, most of the hillside farms in the low country were abandoned, and the cutover and burned-over lands slowly began to reforest, helped along by tree planting programs begun in the 1930's. Many of the timber stands now found in the low country of the Puget Sound area began this way.

Lumbering was Puget Sound's major industry during the first quarter of the 20th century. In 1925, lumber production totaled 3.6 billion

board feet, then declined steadily to a little over 1 billion board feet in 1945. Though the pulp and paper industry had already gotten its start with the Puget Sound Pulp and Paper Company (now Simpson-Lee) at Everett in 1891, significant expansion of this industry came in the 1920's (Hall 1969). A kraft mill was built at Tacoma and sulfite mills at Anacortes, Bellingham, and Everett. Sawmill wastes made up a large portion of the resource used by the pulp industry in these early years (Andrews and Cowlin 1940). As the pulp and paper and plywood industries grew in the Puget Sound area, the lumber industry moved southward in search of a cheaper, move dependable supply of Douglas-fir logs. The pulp industry turned increasingly to logs and pulpwood for raw material — hemlock and spruce were the principal species.

In 1916, labor unions were fighting a vigorous and ultimately successful battle to upgrade working conditions in the logging camps and mills in the Puget Sound area. During the same year, an event occurred which would change the industrial climate of the Puget Sound area and possibly do more to influence development than any other single factor. William Boeing, who had been making private planes in a small Seattle plant, was asked by the Government to build aircraft for use in World War I. This was the beginning of the Puget Sound aerospace industry, which, though subject to economic and employment fluctuations, is now the area's number one industry.[2]

The forest products industry, though far from number one now, is still one of the more important economic factors in the Puget Sound area.[3] Forest products are shipped from Puget Sound mills to worldwide ports, and the industry is the main supporting payroll of many communities. There are now about 148 forest products mills in the eight-county area, including about 65 sawmills, 45 shake and shingle mills, a dozen veneer and plywood mills, 8 pulpmills, and a number of pole and piling yards and log export centers. Although several mills have been in operation 60 years or longer, some new mills have been established within the past 5 years. Some of the older mills have recently been remodeled to increase efficiency and handle smaller logs from the second-growth forests.

The Puget Sound area has had all the elements needed for industry. Its assets include abundant fresh water, deep water ocean ports, a relatively inexpensive source of power, a well-developed transportation system, favorable access to oriental markets, a variety of local resources, and access to resources from the Inland Empire and the Columbia Basin, as well as Alaska and Canada. Much of the Alaska fish industry is headquartered in Seattle, and oil from the recently discovered North Slope oil fields is expected to augment the flow of crude oil to the four existing Puget Sound refineries. (Another refinery is being built in Whatcom County.) Other industries have moved into the Puget Sound area recently, including an aluminum plant in Whatcom County, which has attracted many people to the north end of the Sound. Shipbuilding has been important on the Sound since 1874 when ships were built for the west coast lumber trade. The naval shipyard at Bremerton and a number of private shipyards have been important to the local economy for decades, particularly during war times. The building of small pleasure craft is a growing industry and will probably grow even more in the future if leisure time and affluence increase.

While the Puget Sound area has many industry-drawing factors, it is attractive in other ways. Few areas in the world can match the Puget Sound country for natural beauty, variety of scenery, and diversity of outdoor recreation opportunity (fig. 1) — from mountain climbing, hiking, and skiing thousands of feet above sea level to canoeing in the many lakes and streams, clamming on the beaches, and diving for octopus in the Straits of Juan de Fuca.[4] The outdoor equipment industry has flourished; outdoor clubs number their members in the hundreds and thousands. Tourism and

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[2] *In 1969, the aircraft and parts manufacturing industry employed about 91,000 people, 16 percent of total reported employment in the Puget Sound area (State of Washington 1968).*

[3] *In 1969, the forest industries in the Puget Sound area employed about 22,000 people, roughly 4 percent of total employment and 35 percent of total employment by forest industries in the State.*

[4] *Within the eight-county area are two National Parks, two National Forests, and many State and county parks.*

tourist-catering businesses are growing. The new highway across the North Cascades — expected to open in 1972 or 1973 — and the new North Cascades National Park and Ross Lake National Recreation Area will increase the tourist traffic on both sides of the mountains and no doubt will affect businesses and land managers in the area. The many "amenity resources" of the Puget Sound area also draw industries that are not dependent upon proximity to either markets or raw materials simply because the area is a nice place for people to live.

Industrial expansion, population growth, and the outdoor recreation boom are rapidly changing the character of the Puget Sound area. As in many other areas in the country, thousands of acres of open country are annually being converted to housing developments, highways, and industrial sites. Industries may find further expansion difficult because of limited land, water, power and raw material resources, increasing pollution problems, and perhaps in some cases simply because people do not want the industries to expand for fear of losing other values. Of the many industries caught up in the conflict over allocation of resources, the timber industry is probably the outstanding example. Thousands of acres of forest land are being taken out of timber production each year for residential, commercial, and industrial development. Recreational pressure on remaining forest lands is increasing, and the public is demanding that more forest area be reserved from timber cutting. Our need for timber, our need for places to build houses for people, and our need for open space and natural beauty — all very real — are growing, yet the resources for supplying these needs are declining.

FOREST LAND

Almost 49 Percent of Area, or 3.3 Million Acres, Is Commercial Forest Land

The eight counties of Island, King, Kitsap, Pierce, San Juan, Skagit, Snohomish, and Whatcom have a total land area of 6,753,000 acres. Of this, 4,863,000 acres or 72 percent is forest land, and 3,300,000 or 49 percent is commercial forest land.

Over 1 million acres of forest land are classified as noncommercial because of low productivity, rugged terrain, and adverse location. Over 500,000 acres of physically productive forest land are reserved from cutting and are also classified as noncommercial. Included in this reserved category are the forests in Mount Rainier and North Cascades National Parks, Ross Lake National Recreation Area, National Forest wilderness and natural areas, and numerous State and county parks. Also included as productive-reserved are 13,000 acres of Christmas tree lands in Kitsap and Pierce Counties.[5] For the purpose of this report all lands in San Juan County outside the parks are also considered productive-reserved. Forest land in the San Juan Islands is of low productivity, and an increasing acreage is being developed for residential and recreational purposes; the timber potential of the islands is considered negligible. In 1960, there were an estimated 76,000 acres of commercial forest land in San Juan County.

The commercial forest acreage for King County shown in the tables in this report does not include 49,000 acres of suburban forest tracts in the Seattle area west of a line running north and south through Lake Sammamish and extending the full width of the county. This area is rapidly being urbanized and is classified as nonforest in this report.

Commercial Forest Area Is Decreasing

The total commercial forest area shown in the previous county inventories for the Puget Sound area cannot be compared directly with the current estimate because of changing standards and definitions. In order to ascertain what has been happening, we compared given areas on current photographs with the same areas on photographs used in early inventory work, noting both losses and gains of forest area, and gathered what information was available on acreages of new roads, powerlines, reservoirs, and other forest clearings, as well as records of recently created reserved areas. The results indicated that since 1953 about 165,000 acres of commercial forest land outside the Seattle urban zone have been converted to roads, powerlines, reservoirs, agricultural use, and urban and industrial developments (fig. 2). About 56,000 acres within the Seattle urban zone have been converted to nonforest. Over 300,000 acres of National Forest land (mostly on the Mount Baker National Forest) that had been classified as commercial in the previous inventory have been reclassified as noncommercial. These areas are steep, rocky, unstable, and include isolated pockets of timber on mountain benches and other inaccessible sites (fig. 3). About 65,000 acres of commercial forest land outside San Juan County were set aside in parks and other reserved areas.[6]

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[5] *In 1969, about 567,000 Christmas trees were produced in Kitsap and Pierce Counties, mostly Kitsap. Douglas-fir was the major species (Douglass 1970).*

[6] *Creation of the North Cascades National Park and Ross Lake National Recreation Area had relatively little effect on the commercial forest land area, because most of the park lands had been National Forest wilderness areas and were already classified as noncommercial.*

Figure 2. — Since 1953, about 221,000 acres of commercial forest land in the Puget Sound area have been converted to other uses such as powerlines and agriculture. The powerline right-of-way is in Snohomish County near Granite Falls. Powerline clearings are being used increasingly for Christmas tree production, especially on poorer, gravelly soils where tree growth is slow enough to produce desirable trees. More lands under powerlines could be used for low crops such as blackberries, filberts, fenceposts, and floral greenery. The cleared field is in Whatcom County near Acme.

Figure 3. — Private land bordering public land in the Stillaguamish River Valley, near Darrington in Snohomish County. The farmer-owned "stump ranch" and the bordering hardwood stands occupy old cutover lands in the low country. The front of tall fir timber on the slope marks the boundary of the Mount Baker National Forest. Productive conifer lands grade into steep noncommercial lands sliced by avalanche trails. On the lower slope young conifer timber is encroaching on the hardwoods near the tall timber.

Figure 4. — Looking east over the town of Mount Vernon and the Skagit River Valley, Skagit County — farmer and miscellaneous private lands are in the low country near transportation routes and urban areas, forest industry and State-owned lands in the foothills, National Forest lands in the higher mountains. (Photo courtesy of Washington State Department of Natural Resources.)

About 40 Percent of the Commercial Forest Land Is in Public Ownership

The Mount Baker and Snoqualmie National Forests have 748,000 acres of commercial forest land in the Puget Sound area. Commercial forest area on other public lands, which include Fort Lewis and other military holdings, several Indian reservations, many county- and city-owned tracts, and State of Washington lands (Forest Board, County Trust, school lands, etc.), totals 613,000 acres.

Forest industry owners have 910,000 acres of commercial forest land, or about 28 percent of the total in the Puget Sound area. Farmers and miscellaneous private owners have 1,029,000 acres or 31 percent of the total.

The National Forests are in the higher elevations in the eastern portion of Pierce, King, Snohomish, Skagit, and Whatcom Counties. With a few exceptions, forest industry lands and most of the larger blocks of State lands are in the intermediate elevations just west of the National Forests (fig. 4). There is a checkerboard pattern of ownership throughout much of the Snoqualmie National Forest in King County, with alternate sections owned by Weyerhaeuser Timber Company or the Burlington Northern Railroad. In the Cedar River drainage, the city of Seattle owns several thousand acres of land within the general boundaries of the National Forest.

The U. S. Forest Service and the owners of lands within the National Forest boundaries have been consolidating their lands through an exchange plan. In 1968, for example, several parcels of Forest Service land near Chester Morse Lake were transferred to the city of Seattle in exchange for city of Seattle land in other counties.

In general, the farmer and miscellaneous private lands are located in the lower elevations near the Sound,[7] on islands in the

[7] *The "Sound" as used here includes all salt-water straits, inlets, passages, and bays from the mouth of the Nisqually River in the south to the Strait of Georgia in the north.*

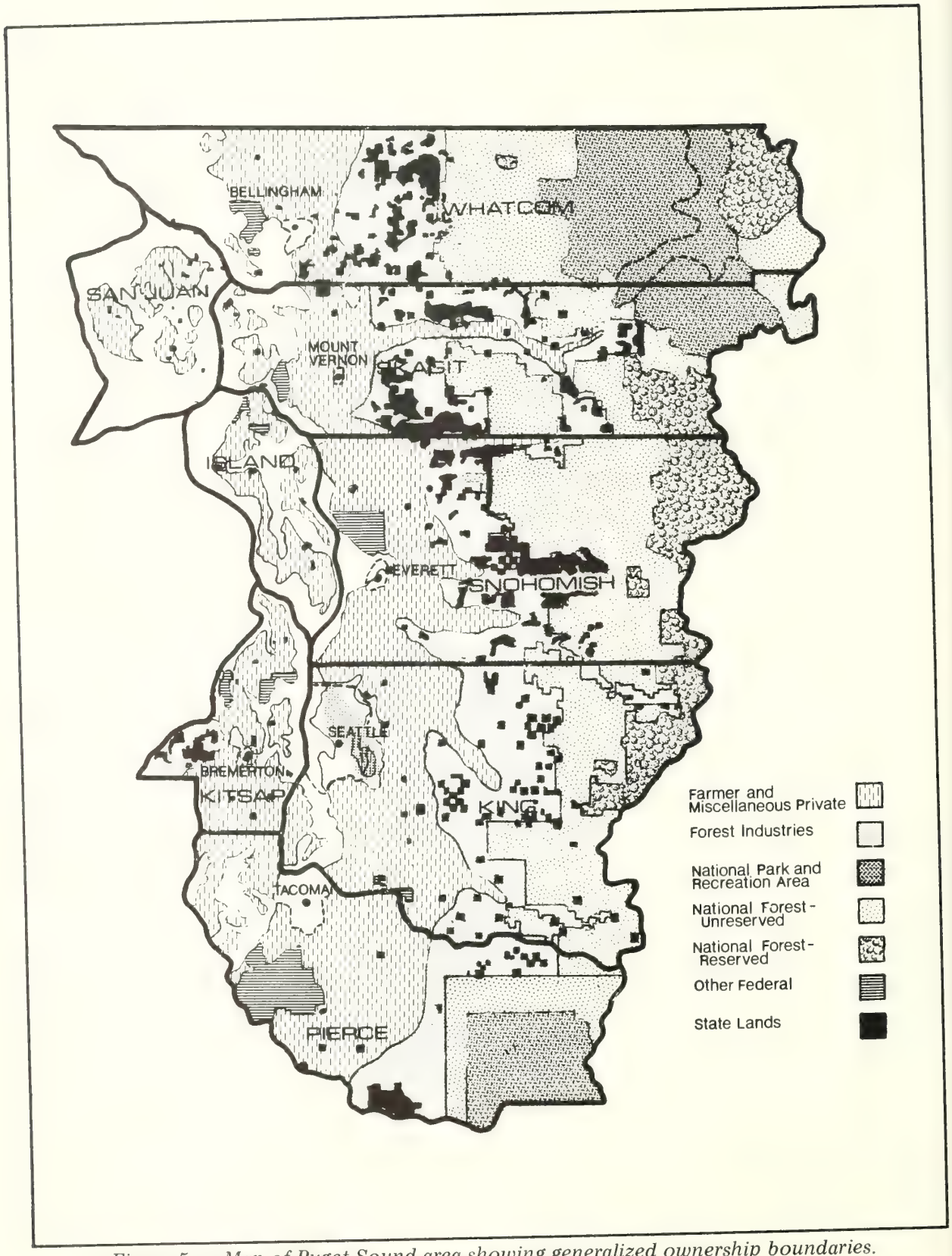

Figure 5. — Map of Puget Sound area showing generalized ownership boundaries.

Sound, and in the east-reaching valleys of the major rivers (figs. 3 and 4). Military lands are mostly in the low elevations, and Indian lands are adjacent to the Sound or major rivers (fig. 5).

About 20 Percent of the Commercial Forest Land Is in Old-growth Timber

Sawtimber stands 140 years or older occupy 628,000 acres, over half of which are on the National Forests (fig. 6). Other public owners have 13 percent of the old growth, forest industries 28 percent, and farmer and miscellaneous private owners 8 percent.

Over 40 Percent of the Commercial Forest Land Is Stocked With Small Young Growth

Over 40 percent of the commercial forest land is stocked with even-aged stands under 40 years old. Some of the young stands in the low country near the Sound represent the third crop of trees since the first lumber mill was established in 1847.

A considerable area of forest land near Tacoma, Seattle, and Everett was cut over prior to 1920 and burned several times after logging. Much of this land became tax delinquent and reverted to the counties, then was later purchased by individuals and timber companies. Some of these cutover and burned-over tracts are now residential areas; those still rural are generally well stocked with trees because of forest fire control over the past three decades and the ability of the land to restock when fire is kept out. A large area, however, is stocked with poor quality trees (fig. 7). Some of the cutover and burned-over lands in the low country have been planted to trees since the 1930's, when many reforestation projects were initiated.

The State of Washington has also acquired large areas of tax-delinquent cutover and burned-over lands, mostly in the foothills and midslopes of the Cascades. The Department of Natural Resources now has an active tree planting program for restocking State lands.

The National Forests have not had the long history of logging that has characterized the private and State lands in the low country and

Figure 6. — Old-growth sawtimber stands occupy 628,000 acres in the Puget Sound area. This old-growth Douglas-fir stand is on the Mount Baker National Forest. National Forests own over half of the old-growth timberland.

Figure 7. — Extensive areas of forest land are producing far below their potential. This area in Snohomish County was apparently logged in the 1920's. It once grew very large Douglas-fir timber but for decades has been poorly stocked with low quality hardwoods, a few scraggly cedars, brush, and bracken fern.

much of the midslopes. However, they do have a considerable area of young growth — 108,000 acres of even-aged stands less than 40 years old and 192,000 acres less than 100 years old. Some logging on both the Mount Baker and Snoqualmie National Forests was done before 1920, though not until World War II did timber harvest reach 100 million board feet a year on either forest. (In 1968, the combined harvest on both forests in this area was 390 million board feet.) Extensive areas of large second-growth timber occupy the old "railroad burns," which occurred during the 1890's and early 1900's when the railroads were being built through the mountains. The National Forests have acquired some cutover land in the past through exchange — and have been planting trees on burned and cutover areas since the 1930's.

Douglas-fir Is the Most Extensive Forest Type, Covering About 30 Percent of the Commercial Forest Area

In the eight-county area, there are 1,018,000 acres of Douglas-fir type. This forest type occurs from sea level to the middle slopes in the Cascades, but it is most extensive on the gravelly glacial deposits near the Sound and in the foothills (figs. 8 and 17). The higher elevations are forested predominantly with hemlock and true firs.

About 60 Percent of the Douglas-fir Type Is in Private Ownership

Private owners have 598,000 acres or 59 percent of the Douglas-fir type; 236,000 acres or 23 percent is on timber company land, and 362,000 acres or 36 percent is on farmer and miscellaneous private land. National Forests have 163,000 acres or 16 percent, and other public owners have 257,000 acres or 25 percent.

Much of the land cleared for agriculture and town sites was originally forested with Douglas-fir, and over 600,000 acres of logged and burned-over country now stocked with hardwoods supported Douglas-fir in the 1800's (fig. 7). It is reasonable to say that Douglas-fir type once covered twice as much land in the Puget Sound area as it does today.

Figure 8. — Young-growth Douglas-fir on glacial till, low country in King County near Auburn. Soils on glacial material in the Puget Sound area are not the best for tree growth, though in general support well-stocked conifer stands. The better residual and alluvial soils in the low country often support hardwoods.

Figure 9. — Western hemlock type covers 882,000 acres in the Puget Sound area and is the most extensive forest type on National Forest lands.

Western Hemlock Is the Second Most Extensive Forest Type, Covering 27 Percent of Commercial Forest Area

Western hemlock type occurs on 882,000 acres of commercial forest land (fig. 9). It is found mostly in the middle and upper elevations of the Cascade Mountains and for this reason is the predominant type on the National Forests, occupying 40 percent of their total commercial forest area. About 20 percent of other public and 24 percent of private commercial forest land are stocked with western hemlock. Over 70 percent of the privately owned hemlock type is on forest industry land.

Upper Slope Types Cover 11 Percent of Commercial Forest Area

Mountain hemlock, true fir (Pacific silver, noble, and subalpine firs), Alaska-cedar, and Engelmann spruce types cover 362,000 acres. These types cover the higher forested slopes of the mountains, grading into western hem-

Figure 10. — Stands of tall, well-formed black cottonwood grown in narrow belts and small groves along streams in the Puget Sound area, on lands that are often too wet for farming or development. Properly managed, the areas could produce a considerable volume of wood fiber and at the same time protect the streamside environment. This stand is in Pierce County near Orting.

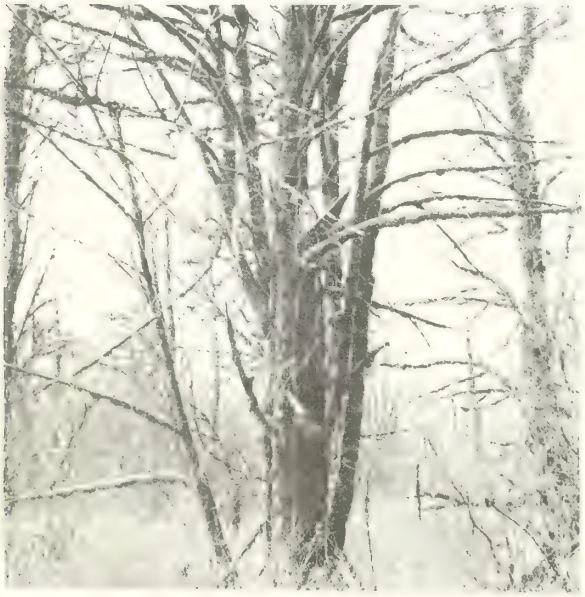

Figure 11. — Thousands of acres of commercial forest land are occupied by low quality trees, such as this bigleaf maple sprout clump near Rockport in Skagit County.

lock at the lower end of their range and straggling out into alpine meadows in the high mountains. The forests near timberline on Mount Baker, Mount Rainier, and Glacier Peak are examples of these upper slope types.

Pacific silver fir is by far the most extensive type in this group, covering 275,000 acres and ranging the length of the Cascade Mountains in the Puget Sound unit. Noble fir is rarely found as a forest type in this area but rather as an individual tree or in pockets of trees in stands of other true firs or hemlock. Noble fir apparently does not occur north of Snohomish County. Subalpine fir type is generally confined to the highest forested areas and Engelmann spruce and Alaska-cedar to moist basins in the high mountains. Mountain hemlock type is more widely distributed and often grades subtly into western hemlock on cool, moist mountain slopes. It appears to occur at lower elevations in the north end of the area than in the south.

The upper slope types have been relatively unimportant from a timber standpoint but are of inestimable value for watershed protection and for their beauty. During recent years, some logging of upper slope types has been done, and it is possible that increasing demands for timber and loss of forest land in the lower elevations will necessitate more intensive use of these forests. The sites on which these types occur are relatively low in productivity, the growing season short, and the land often steep and rocky. Considerably more than an acre of upper slope land is required to produce what an acre in the lower elevations can produce.

Hardwood Types Cover 765,000 Acres or 23 Percent of Commercial Forest Land

Hardwood stands occupy 765,000 acres, more than the total commercial forest land in the National Forests in this area. Hardwood types occur almost exclusively in the low elevations in the western part of the Puget Sound area. Nearly 90 percent of the hardwood area is in private ownership. National Forests have 15,000 acres or only 2 percent of the hardwood area, and these are in river valleys such as the Skagit, Suiattle, and Sauk.

Figure 12. — About 650,000 acres of commercial forest land in the Puget Sound area, that once supported conifer timber, are now stocked with hardwoods. This farmer-owned red alder stand has an unusually well-stocked understory of western hemlock and western redcedar that will eventually take over as the alder dies out. Snohomish County near Oso.

Other public owners have 82,000 acres of hardwoods or 11 percent of the hardwood area.

The principal hardwood type is red alder, which occupies 542,000 acres. Bigleaf maple is the second most extensive hardwood type, occupying 120,000 acres. Other hardwood types found in the Puget Sound area include black cottonwood, Oregon ash, Oregon white oak, Pacific madrone, and, from Snohomish County northward, paper birch. Red alder and black cottonwood stands currently have the greatest value. Red alder stands in general do not produce large volumes per acre. Some stands may yield as much as 30,000 board feet, but 10,000 or less is more common in this area. Red alder trees rarely exceed 90 feet in height and 20 to 25 inches in diameter.

Black cottonwood, though limited in occurrence, often grows to large sizes. Forty- to seventy-year-old stands of black cottonwood, with trees up to 140 feet tall and 30 to 50 inches in diameter, grow in many of the river valleys, often in narrow belts and small groves in lowlands too wet for farming or subject to annual flooding (fig. 10). These areas, if not developed for other uses, could possibily produce a substantial amount of wood annually.

Ash, oak, and maple, though having some commercial value, are of little importance in the Puget Sound area. Stands of these species in this area are often poor in quality with cull trees predominating (fig. 11).

About 650,000 Acres Now Stocked With Hardwoods Have Grown Conifers in the Past

Early logging and forest fires removed conifers — mostly Douglas-fir — from extensive areas in the low country of the Puget Sound area, leaving few conifer seed trees. Light seeded red alder, willow, paper birch (in the northern part of the area), and other hardwoods became established in these areas, grew rapidly, and completely dominated the sites (fig. 12). Some logged or burned areas re-

Figure 13. — Most logged areas on public and forest industry lands are restocked promptly. Aerial seeding of Douglas-fir. (Photo courtesy of Washington State Department of Natural Resources.)

stocked with a mixture of hardwoods and conifers. In many such stands, especially on farmer and miscellaneous private lands, the conifers were cut when they reached merchantable size, but the hardwood trees were left. This type of cutting in the second-growth stands has resulted in forests of crooked, broken, low-value hardwoods on private land in the low country. Now that red alder has commercial value, alder trees are being cut in some areas, but the bigleaf maple and other low value hardwoods are often left to control the site and prevent establishment of conifers or a new crop of red alder, both of which require full overhead light for seedling development.

Timber companies and some public landowners have been replacing hardwood stands with conifers, but most of the hardwood area is in farmer and miscellaneous private ownership. These owners of small forested tracts are often not interested in investing in timber stand improvement, and a very large number are planning to sell their land or develop it for residential, commercial, or other nonforest uses.

Less Than 2 Percent of the Forest Land Is Nonstocked

The survey found 53,000 acres of commercial forest land that were less than 16 percent stocked with growing-stock trees. This is not a great deal more than the 30,000 to 40,000 acres that are being clearcut annually, indicating relatively successful reforestation on most lands (figs. 13 and 14). The present low acreage of nonstocked lands contrasts sharply with the situation that existed in 1933, when about 850,000 acres or nearly 20 percent of the forest land was nonstocked. Now less than 2 percent of the area is nonstocked, a comment on the success of forest fire control and forest management since the 1930's, but probably more, a testimony to the recuperative ability of the forest land in the Puget Sound area.

Sixty Percent of the Commercial Forest Land Is Capable of Growing 120 Cubic Feet or More Per Acre

About 2 million acres, or 60 percent, of the 3.3 million acres of commercial forest land in the Puget Sound area is capable of growing 120 cubic feet or more per acre per year (see table 7).[8] Of these 2 million acres, about 58 percent is in private ownership and 42 percent in public ownership.

In general, the low elevation forest lands between the foothills of the Cascade Mountains and the Sound are not the best tree-growing sites in the area, though comparatively few areas in the world outside the Northwest can match them. Much of the low coun-

try outside the river valleys is covered by a mantle of glacial till (fig. 8) especially in the south portion of the area and on the Kitsap Peninsula and Whidbey Island. The soils are gravelly and tend to become droughty in the summer. Much of the fertile river bottom land is now used for agriculture or urban and industrial sites. Though farmer and miscellaneous private lands — predominantly low country between the foothills and the Sound — include 555,000 acres or 28 percent of the land capable of growing 120 or more cubic feet per acre, they have only 128,000 acres or 16 percent of the land capable of growing 165 or more cubic feet per acre. Forest industry lands — concentrated in the mid-elevations — include 265,000 acres or 34 percent of the land capable of growing 165 or more cubic feet per acre, and 66,000 acres or 40 percent of the land capable of growing 225 or more cubic feet per acre. Forest industry and other public lands[9] combined — in other words, most of the foothill and midslope country — contain 431,000 acres, or 55 percent of the land capable of growing 165 or more cubic feet per acre. National Forests have 227,000 acres or about 29 percent.

The poorer sites are mostly in National Forest and farmer and miscellaneous private ownership, these two ownerships combined holding 354,000 acres or about 65 percent of the land incapable of producing 85 or more cubic feet per acre per year. The low site National Forest lands are in the higher mountains.

The average productive capacity for all owners combined in all counties is about 131 cubic feet per acre per year, or roughly 650 board feet. Public lands have a slightly greater average productive capacity than private lands — 132 cubic feet per acre for public owners, 130 cubic feet per acre for private owners.

[8] *In terms of McArdle's Douglas-fir yield tables, this is about site index 130 and higher. The cubic-foot classification makes possible comparison of different site classes for different species, providing a basis for rating relative potential of all forest land.*

[9] *Although some of the other public lands are in the lower elevations (military and Indian reservations in particular), State lands comprise nearly three-fourths of the total other public acreage and are located mainly in the mid-elevations.*

Figure 14. — Young men from a State youth camp plant tree seedlings on State-owned land. (Photo courtesy of Washington State Department of Natural Resources.)

TIMBER VOLUME

Live Sawtimber Volume Totals 75 Billion Board Feet

For all ownerships, the total sawtimber volume in trees 11.0-inch d.b.h. and larger is about 75 billion board feet, International ¼-inch scale. Softwood volume is 70 billion; hardwood volume, 5 billion. Total growing-stock volume in trees 5.0-inch d.b.h. and larger is about 15 billion cubic feet, with 13 billion in softwoods and 2 billion in hardwoods.

Timber Volume Is Decreasing

Since 1953, total volume of timber in the Puget Sound area has decreased, though hardwood volume has been increasing. Softwood sawtimber volume has decreased an estimated 11 percent. Table 1 shows estimated volumes for 1953, 1963, and 1967. The figures for 1953 and 1963 were developed from the 1967 inventory data using a stand projection technique which allowed backdating using historical growth, cut, and mortality rates, and changes in forest area. These figures provide a better estimate of real change over time than can be obtained from the previous inventory statistics, because of different standards and definitions used in the previous inventories.

There are three primary causes for the decrease in softwood volume: (1) annual cut exceeding growth, (2) the shift of commercial forest land to reserved status, and (3) the conversion of low elevation commercial forest land to nonforest uses. The causes for the increase in hardwood volume are: (1) stocking since 1953 of many old burns and cutovers with hardwoods, and growth in hardwood stands already established in 1953, (2) removal of conifers from mixed conifer-hardwood stands, thus releasing the hardwoods from competition and accelerating their growth, and (3) low annual cut of hardwoods because of limited demand.

Though total softwood volume over the entire eight-county area has decreased since 1953, there has been a slight increase in softwood volume in Island and Kitsap Counties. This has come about because most of the old-growth

Table 1. Comparison of net volume of growing stock and sawtimber on commercial forest land by softwoods and hardwoods, Puget Sound area, Washington, 1953, 1963, and 1967

Year	Growing stock			Sawtimber		
	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million cubic feet			*Million board feet (International ¼-inch scale)*		
1953	14,919	13,689	1,230	81,507	78,520	2,987
1963	15,294	13,608	1,686	80,050	75,510	4,540
1967	14,715	12,914	1,801	74,859	69,751	5,108

timber had already been logged from these lowland counties by 1953, and much of the forest land restocked with Douglas-fir. Growth in these two counties has been greater than the loss of volume by logging on commercial forest land and clearing of forest land for other uses.

Sixty-three Percent of the Sawtimber Volume Is on Public Lands

National Forests have 36.3 billion board feet (International ¼-inch scale) or 49 percent of the sawtimber volume, and other public owners have 10.6 billion board feet, or 14 percent. Timber companies hold 16.2 billion board feet of sawtimber or 22 percent, and farmer and miscellaneous private owners hold 11.7 billion or 15 percent. Over 14 percent of the private sawtimber is hardwoods — three-fourths of this is held by farmers and miscellaneous private owners; only about 2 percent of the public sawtimber is hardwoods.

National Forests Have 70 Percent of the Old-growth Sawtimber Volume

The total volume in stands 140 years and older is about 47 billion board feet (International ¼-inch scale). This is about 63 percent of the total volume in all stands. National Forests have about 33 billion board feet in stands 140 years and older, or 70 percent of the total old growth. The old-growth stands on National Forest lands are predominantly western hemlock and Pacific silver fir, these two species contributing 58 percent of the total volume in softwood trees, 21-inch d.b.h. and larger. In spite of this, National Forests hold about 54 percent (6.6 billion board feet) of the total Douglas-fir volume in trees, 21.0 inches and larger.

Hemlock Is the Most Plentiful Sawtimber Species; Douglas-fir Second

Though Douglas-fir is the most extensive forest type in the Puget Sound area, there is slightly more western hemlock sawtimber volume — 24 billion board feet of hemlock, compared with 21 billion board feet of Douglas-fir. This is because much more of the Douglas-fir type is young growth with less volume per acre.

Douglas-fir is, and for decades has been, one of the most important commercial woods in the world, used for structural timbers, dimension and shop lumber, flooring, doors, veneer, plywood, piling, and railroad ties. Douglas-fir has been the prime factor in the economic development of much of Oregon and Washington west of the Cascade Mountains. In the Puget Sound area, Douglas-fir is used proportionately less now than in the 1930's (Andrews and Cowlin 1940), mainly because much of the old-growth Douglas-fir has been cut. Even so, about 55 percent of the sound log consumption by sawmills in the Puget Sound area in 1968 was Douglas-fir — about 29 percent was hemlock; and about 50 percent of the sound log consumption by veneer and plywood mills was Douglas-fir — 37 percent was hemlock.

Western hemlock is now second in importance to Douglas-fir in western Oregon and Washington. Prior to 1930, western hemlock was not readily accepted by lumber users. Seasoning techniques had not been perfected; and the prejudice against eastern hemlock wood, which is harsh and splintery under tools, splits easily, and has low nail-holding capacity, was extended to western hemlock, which is generally superior. Western hemlock is now used in a variety of products, including general construction lumber, siding, flooring, boxes, and crates. Its greatest use in the Puget Sound area is for pulp. In 1968, 285 million board feet of hemlock logs were used by pulpmills in the Puget Sound area. This is about 53 percent of total consumption of all species by the pulp and board industry[10] and nearly a third of total hemlock consumption.

Pacific silver fir is the third most plentiful species, and 65 percent of it — 8.4 billion board feet out of 13 billion — is on the National Forests. This species and the other true firs (noble fir, grand fir, and subalpine fir) that occur in the Puget Sound area were used very little by the forest industries before World War II, and most of what was used went into pulp (a small amount of noble fir lumber was sawn). The

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[10] *Included are manufacturers of chipboard, particleboard, hardboard, and similar products.*

main reason true firs were not used very much is that they were generally inaccessible. With the exception of scattered grand fir trees in the valleys (grand fir is also called lowland white fir), the true firs grow on the upper slopes of the mountains. In most areas these mountain forests had not been opened to logging until fairly recently.

In 1968, the total consumption of true fir logs in the Puget Sound area was 212 million board feet, about 9 percent of total consumption of all species. About 52 percent of true fir consumption went into pulp, and about 35 percent was exported. About 7 percent went into lumber, and 6 percent went into veneer and plywood.

Redcedar Volume Totals Over 6.7 Billion Board Feet, Most of Which Is Old Growth

Western redcedar sawtimber volume totals 6.7 billion, and 76 percent of this is in trees, 21.0-inch d.b.h. and larger. About 58 percent of the redcedar volume is on National Forest land, and 77 percent is in the northern counties of Skagit, Snohomish, and Whatcom.

Pure stands of redcedar are relatively rare in the Puget Sound area; only 204,000 acres, or 6 percent, of the total commercial forest land qualifies as redcedar type by Forest Survey standards. More commonly, redcedar occurs as an associated species with most of the conifer or hardwood types, favoring the cool, wetter places such as north slopes and canyon bottoms.

Western redcedar has been an important timber species since the early lumbering days in Puget Sound and has been used extensively for sills, siding, shakes, and shingles. In 1968, there were about 50 shake and shingle mills in the Puget Sound area, and 10 of them had been in operation for 5 years or less. The total log consumption by shingle and shake mills was over 68 million board feet. About 90 percent of their log supply — nearly all of which was western redcedar — came from the Puget Sound area. The demand for cedar shakes and shingles has increased during the past few years with a corresponding increase in the annual cut of redcedar. The reported volume of cedar harvested in the woods in the Puget Sound area in 1968 was 114 million board feet, compared with about 90 million in 1957. About 91 percent of the total 1968 cedar harvest was old growth, and over 1 percent was salvage, leaving less than 8 percent of the cedar harvest in young growth. Presently young-growth cedar is being used very little in the shingle and shake industry, primarily because it is considered unsuitable. It has a high percentage of sapwood, is knotty, and tends to have worm holes in it.

Currently, little effort is being made to grow western redcedar on a sustained yield basis. Douglas-fir, hemlock, and, on some higher elevation sites, true firs are being planted after old-growth stands are cut. Some volunteer redcedar seedlings are becoming established on cutovers, and to a certain extent redcedar is being left after selective logging on private timberlands in the low elevations. Often the cedars left growing are highly defective. The low elevation forest tracts may not remain in forest use in the future.

For these reasons, it seems that redcedar volume will decline in the future.

Hardwood Sawtimber Totals 5 Billion Board Feet

The volume of all hardwood species totals 5.1 billion board feet (International ¼-inch scale), 3.1 billion or 61 percent of which is red alder. Hardwood trees in the Puget Sound area are generally of small diameter, are shorter than conifer trees of the same diameter, and have less volume. There is a greater proportion of low quality and cull hardwood trees than conifers. The cubic-foot volume of cull hardwood trees is about 6 percent of the volume of growing-stock hardwood trees; volume of cull softwoods is only 1 percent of softwood growing-stock volume.

In the early logging days in the Puget Sound area, hardwoods were considered worthless for timber. By the 1930's, some use was being made of red alder for furniture, turnery products, and fuel; some bigleaf maple was used for furniture, veneer, and fuel; and black cottonwood was used in small quantities for pulp, excelsior, and cooperage. Hardwoods are being used much more now than in the 1930's. From 1925 to 1933, the average annual harvest of hardwoods in the Puget Sound area was about 7

million board feet. In 1968, about 65 million board feet of hardwoods were harvested; 145 million board feet were consumed by mills in the Puget Sound area. Alder and cottonwood are the primary species being used now, though other hardwoods do occasionally enter the market. Pulp, veneer, and lumber are made from alder and cottonwood. Over 100 furniture manufacturers in southern California use red alder from the Pacific Northwest. A small amount of wall paneling has been made from red alder. In the Puget Sound area in 1968, about 39 million board feet of hardwood logs were sawn into lumber, 4 million were used in veneer and plywood, and about 102 million went into pulp.

Though hardwood volume has been increasing in the Puget Sound area, it will probably decrease in the future for these reasons: (1) hardwoods grow almost exclusively in the low country near the Sound, the major rivers, the transportation routes, and the heavily populated areas where land is being converted to nonforest uses, (2) many forest managers are replacing hardwood stands with conifers on lands committed to timber production, and (3) hardwoods -- especially red alder — are relatively short-lived; many stands are already deteriorating and slowly being replaced by understory conifers (fig. 12).

Salvable Dead Timber Volume Totals About 2.8 Billion Board Feet

In the eight-county area on all ownerships, there were about 2.8 billion board feet, International ¼-inch scale, of salvable dead sawtimber at the time of inventory. About one-third of this was western hemlock, and one-fourth was true firs, mostly Pacific silver fir. (The wood of western hemlock and true fir trees tends to deteriorate rapidly after death.) Cedar made up 16 percent of the salvable dead volume and Douglas-fir, 15 percent. About 762 million board feet of hemlock and 596 million board feet of true fir, approximately 80 percent of the salvable dead volume in these two species, were in trees that had 500 or more board feet of sound wood.

For all species combined, about 1,613 million board feet, or 57 percent, was in concentrations of 5,000 or more board feet per acre.[11]

[11] *This information comes from 1/5-acre and 1-acre plots. No information is available on size of areas in which concentrated volumes of salvable dead timber were found.*

GROWTH, CUT, AND MORTALITY

Current Net Annual Growth Averages 412 Board Feet Per Acre

Current net annual growth of sawtimber on commercial forest land is 1,359 million board feet, International ¼-inch scale, about 1.8 percent of current inventory volume. Average net annual growth for all ownerships is 412 board feet per acre. Forty-two percent of the growth is Douglas-fir, and 26 percent is western hemlock. About 13 percent of the growth is in hardwood species, mostly red alder.

Net annual growth of growing-stock trees is 298 million cubic feet, about 2.0 percent of inventory volume; 79 percent is in conifer species, and 21 percent is in hardwoods.

Two-thirds of Cubic-foot Growth Occurs on Private Lands

Net annual growth of growing stock on National Forest and other public lands is 94 million cubic feet, or about 32 percent of total growth; and growth on private lands is 204 million, or 68 percent of the total.

Net annual growth on National Forest and other public lands averages 69 cubic feet per acre; on private lands growth averages 105 cubic feet per acre. The difference in growth rates between public and private owners is primarily due to the greater acreage in young-growth stands on private lands. On National Forest and other public lands, about 69 percent of the stands are less than 140 years old, compared with 87 percent on private lands. For all owners combined, 82 percent of total net annual growth is in stands under 100 years old, and 90 percent in stands under 140 years old.

Farmer and miscellaneous private owners have the highest cubic-foot growth (table 25) because they have virtually no old-growth timber and a larger acreage than any other owner group in 20- to 50-year-old stands — the age span of greatest periodic growth on most Douglas-fir sites (McArdle, Meyer, and Bruce 1961).

To a certain extent, total annual growth for farmer and miscellaneous private lands is misleading. About 30 percent of the growth in these lands is on hardwood trees, which are generally of poorer form, have less usable volume for a given diameter, and are currently less valuable than conifer trees.

Cut Exceeds Growth by 4.1 Percent

From 1963 to 1967, the annual cut of live trees in the eight-county area averaged 1,415 million board feet, International ¼-inch scale. This is 56 million feet, or 4.1 percent greater than net annual growth. The following tabulation shows growth, average annual cut from 1963 to 1967, and net effect on inventory by ownership classes.

Ownership	Live cut	Net annual growth	Annual change in inventory
	(M bd. ft., Int. ¼-inch)		(Percent)
National Forest	390,000	115,400	-0.76
Other public	153,000	336,900	+1.74
Private	872,000	906,400	+ .12
All ownerships	1,415,000	1,358,700	- .08

It is difficult to make a meaningful analysis of cut and growth in an area such as Puget Sound. There are still extensive areas of wild, old-growth stands that are growing very slowly or declining because of high mortality rates. On the other hand, there are extensive areas of fast-growing young timber, some of which will never be managed for continuous timber production. A considerable area of well-stocked young conifer timber north of Seattle is being converted to industrial, commercial, and residential sites. Throughout the Kitsap Peninsula and on much of Whidbey Island, lands that are well stocked with young-growth Douglas-fir are being sold in 3- to 10-acre tracts for homesites. The same sort of thing is happening in a rather random manner throughout the lower elevations on the mainland from Olympia to the Canadian line. These developments could well end timber production entirely on hundreds of thousands of acres (a more detailed discussion, "Prospective Loss of Timberland," follows this chapter).

Following is a discussion of some other factors bearing upon the cut-growth relationship for the various ownerships in the Puget Sound area.

National Forests are currently decreasing their inventory volume on lands committed to timber production, as they steadily convert wild, old-growth stands to managed young growth.[12] The long-term goal is a regulated forest with a relatively even distribution of stand age classes to provide continuous timber production and at the same time preserve or enhance other resources, such as wildlife, water quality, soils, and scenery. Though cut is currently more than growth on National Forest timberlands, growth will increase in the future — as more old-growth timber is cut and lands are restocked with young stands and as the 89,000 acres of seedling and sapling stands become large enough to start putting on measurable cubic- and board-foot growth.

Other public owners as a group are cutting considerably less timber than is growing on their lands. These lands are in many small and a few large parcels, scattered throughout the Puget Sound area, in the low country between the foothills and the Sound as well as the foothills and the midslopes of the Cascades. They are managed by many different agencies. Included are the Department of Natural Resources, Bureau of Indian Affairs, various military posts (Fort Lewis and Whidbey Island Naval Air Station are two examples), counties, and cities (Seattle's Cedar River Watershed, for example). Some tracts of land in this other public owner group are being intensively managed for timber production; others are being managed primarily for different purposes (city watersheds, for example), though some timber harvesting is being done. Some tracts of land are not being managed for timber production at all, because they are being considered for sale, future conversion to parks or institutional sites, or other purposes.

Cut and growth for all private lands combined are nearly in balance, yet on an individual owner basis some lands are being heavily cut and others not at all. Included in the private ownership group are several timber companies, many of which are managing their lands for continuous timber production; some large nontimber industry corporate owners who may plan to manage for timber production but may also have other objectives; and a great number of farmers and miscellaneous noncorporate owners with various objectives.

Timber Cut Is Shifting From Private Lands to Public, From Douglas-fir to Hemlock

The volume of timber harvested in the Puget Sound area in 1968 was only 20 percent less than the average volume harvested annually between 1925 and 1933.[13] The 1925-33 harvest, however, came almost exclusively from private lands, whereas about 37 percent of the 1968 harvest came from public lands, mostly National Forest and State of Washington. Another im-

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[12] *This discussion applies only to lands classified as commercial forest land on the National Forests. Hundreds of thousands of acres of National Forest land are classified noncommercial; these include areas where timber cutting would be unwise because of physical factors and areas set aside by statute to be preserved in their natural state. Timber harvest is prohibited on these areas. Growth of timber on these lands is not included here.*

[13] *The year 1925 marks the peak of lumber production, which dropped steadily from 3.6 billion board feet that year to about 1.2 billion in 1945. Log harvest declined from 2.4 billion in 1925 to about 1.0 in 1945. The 1920's and 1930's also saw many forest protection and regeneration programs started and, generally speaking, the beginning of sustained yield forestry in the Northwest.*

Figure 15. — In the Puget Sound area, most logging operations are now in steep, mountainous terrain. This logging operation near Darrington on the Mount Baker National Forest is in hemlock and Pacific silver fir which, combined, make up nearly 50 percent of the current timber harvest on all ownerships.

portant difference is the distribution of the annual cut by species: over two-thirds of the 1925-33 cut was Douglas-fir, which now makes up less than one-third. Hemlock comprised about 19 percent of the cut in the 1925-33 period, compared with 45 percent now. True firs and hardwoods made up less than 1 percent in 1925-33, compared with 16 percent now (fig. 15).

Annual Mortality Exceeds 400 Million Board Feet

Average annual mortality in all stands across all ownerships is about 430 million board feet (International ¼-inch scale), or about 130 board feet per acre. This is about 0.6 of 1 percent of the total inventory volume. Total and per-acre mortality are heaviest in those ownership classes with the greatest proportion of their holdings in old-growth stands.

Ownership	Percent of area in old-growth timber	Board-foot mortality per acre (Int. ¼-inch)
National Forest	44	290
Other public	13	96
Forest industry	28	124
Farmer and miscellaneous private	5	40
All ownerships	19	130

The immediate cause of over 50 percent of the mortality of all species on all ownerships was weather — mostly windthrow and snowbreak. About 12 percent of the mortality was attributed directly to disease and only 3 percent directly to insects, though both could have contributed to the death of trees from other causes. About one-fourth of the dead trees tal-

lied on plots were assigned an unknown cause of death. Insects or diseases could have contributed to the death of many of these trees.

Currently there are no devastating insect or disease epidemics in the Puget Sound forests, though a number of potential troublemakers exists. The balsam wooly aphid, which has killed over a billion board feet of true fir timber (mostly Pacific silver fir) in southwestern Washington (Mitchell 1966), has caused mortality in subalpine fir as far north as the headwaters of the Skykomish River in Snohomish County. So far, the impact has been in noncommercial areas and the damage primarily to scenic values.

The hemlock looper, a native insect that has killed millions of board feet of timber in Oregon and Washington since 1900, has caused some damage in the Skagit River drainage on the Mount Baker National Forest. Mortality, however, has been light.

There have been some minor outbreaks of Douglas-fir beetle in the past 2 or 3 years in the Baker River area of the Mount Baker National Forest. The mountain pine beetle has killed a large number of western white pine trees on both the Snoqualmie and Mount Baker National Forests. In many cases, the white pine trees were weakened by the white pine blister rust before the beetles attacked. White pine is a minor species in the Puget Sound area, making up less than 0.2 percent of total sawtimber volume. The negative annual growth shown for other softwoods on National Forest lands in table 27 is due primarily to mortality of white pine exceeding white pine growth.

Childs and Shea (1967) have estimated that forest diseases cause annual losses of 3,133 million board feet in the Pacific Northwest. Growth loss and cull together far exceed losses due to mortality. In the Puget Sound area, heart rots cause considerable loss of usable wood volume due to cull in old-growth stands but generally do not kill trees. Root rots, the most important of which is *Poria weirii*, are found in the Puget Sound area, primarily in young-growth stands. Losses from root rots are mainly in mortality and growth impact. Dwarf-mistletoe in hemlock is one of the major disease problems in the Puget Sound area, causing cull and reducing growth. It generally does not cause mortality except in very old stands where it weakens trees and makes them susceptible to insect attack or unable to survive periods of drought.

One-third of Mortality Is Hemlock

About one-third of the mortality is hemlock, and much of this, again, comes from the old-growth stands in National Forest land. Western hemlock dieback has been a singularly serious problem on the Mount Baker National Forest for over a decade.[14] Until recently the cause was unknown.

Apparently the tops of old western hemlock trees (350 years or older) begin to die in periods of warm, dry weather possibly because the tips farthest from the roots lose moisture faster than it can be replaced when humidity is low. A heart-rotting "coral fungus" then enters the dead branches in the top. In many cases, dwarf-mistletoe also becomes a factor (dwarf-mistletoe often develops prodigiously in hemlock stands that are opened up to light by selective logging, storm damage, or other causes).[15] For several years the Mount Baker National Forest has been concentrating its timber sales in areas of heavy hemlock dieback.

True firs account for about 21 percent of the mortality, western redcedar 17 percent, and Douglas-fir 15 percent.

Though mortality constitutes a loss of timber production, not all of the mortality volume is lost. In 1968, the reported harvest of dead trees in the eight-county area was 57.2 million board feet. This harvest of dead trees offsets about 13 percent of the total annual mortality. Over 95 percent of this came from National Forest lands. The salvage of dead material on National Forest lands is equal to more than 25 percent of annual mortality on the National Forests, though some of the material being salvaged is from trees that have been dead many years.

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[14] *Mountain hemlock trees in the same area do not seem to be affected by these "dieback" agents.*

[15] *Personal communication with Kenelm Russell, forest pathologist, Washington State Department of Natural Resources.*

PROSPECTIVE LOSS OF TIMBERLAND

Forest Area Is Decreasing With Increasing Population and Industrial Expansion

In 1950, the population of the Puget Sound area was about 1.3 million. A preliminary summary of the 1970 census shows about 2.1 million. The increase in population in the eight-county area from 1950 to 1970 was over 75 percent of the increase for the entire State of Washington for the same period and about 38 percent greater than the population increase for the entire State of Oregon (U. S. Department of Commerce 1969).

Along with the increase in population has come an increase in industrialization. Past trends and current activity indicate that the Puget Sound area will become even more urbanized and industrialized in the next two or three decades. The population for 1990 in King, Kitsap, Pierce, and Snohomish Counties has been projected at about 2.9 million (Pethick 1969), and the population of the eight-county area is projected at over 4 million for 2000. The increase in population will probably be accompanied by shorter workweeks; increasing disposable income, some of which people will spend on boats, campers, back-country vehicles, and second homes in the forests; and an ever-increasing technology demanding more land for factories, warehouses, offices, roads, landing strips, parking lots, and electric power generating plants and powerlines. The effect of all these factors will be to increase the pressure to convert timber-growing land to other uses.

Some timberland will be physically converted to other uses such as residential areas, industrial sites, roads, powerlines, garbage dumps, etc. (fig. 16). Some areas that may continue to support trees may not be used for timber production. Included might be buffer strips of trees to screen blight and noise, wooded institutional grounds, and areas restricted from timber harvesting because higher priorities have been given to recreational and scenic purposes. A substantial acreage of forest land may become so valuable that taxes and incentives to convert to nonforest use will make timber production economically unattractive. In many areas privately owned timberland is being subdivided into small parcels, making timber management activities impractical.

No one is able to say how much commercial forest will be lost with a gain of a million persons in the area, or exactly what pattern future development will take. Many planning organizations, including the Puget Sound Governmental Conference, various county planning groups, and the Washington State Department of Natural Resources, have been studying these problems and developing land use plans. Land use plans and even zoning laws have often proved to be effective only for short terms but nevertheless provide a basis for planning and making projections.

The Washington State Department of Natural Resources has adopted a multiple use resource zoning plan for State-owned lands. The plan provides a framework in which land and other resources will be managed to meet the Department's objectives, which are to: "(1) obtain maximum sustained economic benefits to the trusts to which the land is dedicated while fulfilling the basic social obligations common to all large forest and range land ownerships;

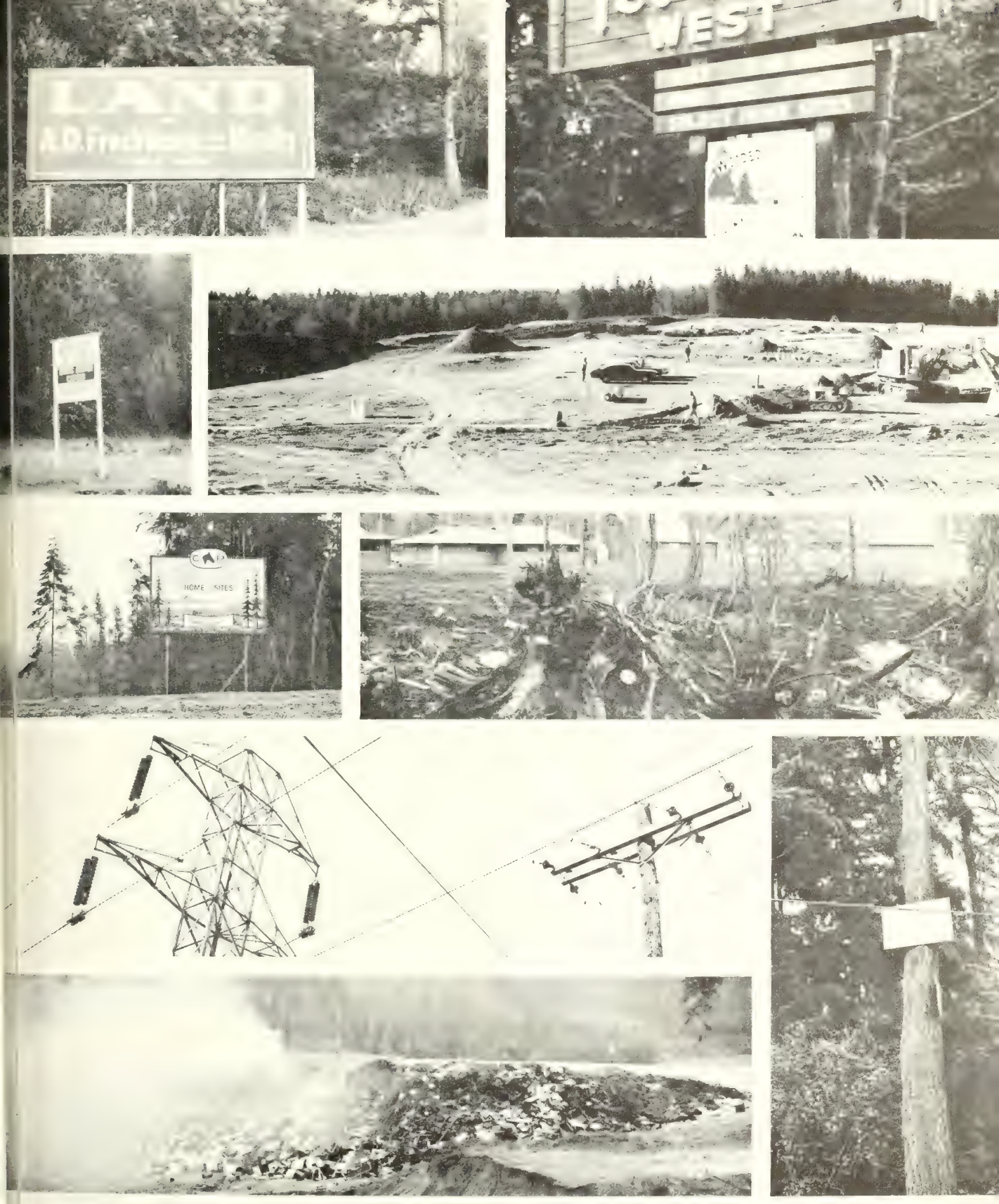

Figure 16. — Over 1 million acres of forest land in the Puget Sound low country may be converted to other uses by the year 2000.

Figure 17. — Thousands of acres of young-growth Douglas-fir stands in the Puget Sound low country could be thinned. Thinning would increase yields and often result in more esthetically appealing forests. Present land use trends are discouraging land owners from engaging in forest management activities in the low country. This 45-year-old Douglas-fir stand is on Whidbey Island near Freeland, Island County.

and (2) when not in conflict with the first objective, to maximize social benefits to the people of the State" (State of Washington 1969).

The Department has classified all State-owned lands into "resource zones" and has drawn boundaries around all lands in these zones for the present, for 1980, and for 2000. Though the State's classification does not apply to private lands within a given "resource zone," the zone classification was based to a large extent on the present and expected future use of all lands in that zone. The Department's projections are based on past trends and development patterns and rates during a period when there was essentially no control over land development. Already, many organizations are trying to change the direction of development. Current and proposed legislation is geared to check urban spread and favor preservation of open space. For these reasons, estimates of future forest land conversion based on the Department's resource zoning might be considered outside limits or maximums.

The Department's Year 2000 Urban Zone is defined as "anticipated growth area on fringes along urban zone, 1980, geographically suited for development; characterized by high land values, usually timber-covered and may be interspersed with widely scattered housing developments only on choice sites." Developments on private land are dispersed throughout much of this area and are increasing.

The Department's Year 2000 Urban Zone line generally follows the base of the Cascade foothills and conforms in many places with the generalized boundary between the farmer and miscellaneous private lands and the forest industry and State of Washington timberland shown in figure 5.

Following is a discussion of the estimated forest resources within the Year 2000 Urban Zone.

Commercial Forest Land Area May Decrease by Over 1 Million Acres by 2000

Within the Department's Year 2000 Urban Zone in the Puget Sound area there are currently an estimated 1,154,000 acres of commercial forest land. This is about 35 percent of the total commercial forest land in the eight-county area, about 11 percent of the total in western Washington, and slightly less than 5 percent of the Douglas-fir region. Farmer and miscellaneous private owners hold 785,000 acres or 68 percent of this area. Forest industry owners have 203,000 acres or 18 percent, and other public owners have 165,000 acres or 14 percent. Practically all of this land is stocked with young timber stands under 90 years old, and 54 percent is stocked with stands under 50 years old (fig. 17). About 43 percent of all young-growth stands in the Puget Sound area is in this prospective urban zone.

Nearly Half of the Douglas-fir Lands May be Converted to Nonforest Uses

About 482,000 acres of the commercial forest land in the prospective urban zone are currently in Douglas-fir type. This is about 47 percent of the total Douglas-fir type acreage in the Puget Sound area. In addition, about 410,000 acres, or over 60 percent of the hardwood stands on conifer sites (mostly Douglas-fir), is in this prospective urban zone. Thus, the total loss of land capable of growing Douglas-fir may exceed 890,000 acres.

Sawtimber Volume in the Prospective Urban Zone Totals 12 Billion Board Feet

In the Year 2000 Urban Zone, there are currently an estimated 12 billion board feet (International ¼-inch scale) of sawtimber. This is about 16 percent of the total volume in the eight-county area for all ownerships and 31 percent of the volume outside the National Forests. About 9 billion board feet is softwoods and 3 billion, hardwoods. Growing-stock volume in the prospective urban zone totals 3.2 billion cubic feet or about 22 percent of the total volume for all ownerships in the eight-county area and 36 percent of the volume outside the National Forests.

Annual Growth in Prospective Urban Area Exceeds One-half Billion Board Feet

Current net annual growth of sawtimber in the prospective urban zone is 502 million board feet (International ¼-inch scale), about 37 percent of total growth in the eight-county area. About 20 percent of the growth is hardwoods. On many sites in the prospective urban area, current growth is far below the full capacity of the land. The potential loss in terms of timber production is therefore even greater than these figures indicate.

Potential Production of Timber May Be Reduced by 30 Percent

If all the commercial forest land within the Year 2000 Urban Zone is converted to nontimber uses, the estimated loss in potential yield capacity would be about 130 million cubic feet or 30 percent of the potential for the entire Puget Sound area. The present potential yield capacity of all lands in the Puget Sound area is 432 million cubic feet per year.[16] These estimates are based on normal yield tables (McArdle, Meyer, and Bruce 1961; Barnes 1962; Worthington, Johnson, Staebler, and Lloyd 1960) and site classification of lands in the area.

In general, the area within the Year 2000 Urban Zone is below the average productivity for the entire Puget Sound area, being predominantly Douglas-fir site 160 and lower and having but 16 percent of the site 170 and better lands. For this reason the potential reduction in productivity is somewhat less than the commercial forest acreage within the Year 2000 Urban Zone — 35 percent of the entire area — might indicate.

Intensive management may possibly change the relative yields from forest lands. Some tim-

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[16] *The total potential yield from National Forest lands, as from most lands, will probably never be realized. National Forests now cut considerably less than annual yield from roadside areas, tracts near streams, campgrounds, and other landscape-management areas. Reductions in yield realization due to such harvest restraints could amount to 20 or 30 percent, or more in the future.*

ber companies expect considerably greater yields from future forests than shown in normal yield tables. Data in this report show that growth on forest industry lands is still less than three-fourths of the potential as shown in normal yield tables developed for unmanaged stands. For all owners combined, present growth is only 69 percent of potential as shown in these normal yield tables. Foresters still have not achieved production equal to that from fully stocked **unmanaged** stands. Several timber companies and Government agencies are currently engaged in activities to increase future production: in many areas hardwood stands on conifer sites are being replaced with conifers; some timber companies and the Department of Natural Resources are fertilizing young timber stands; thinning is becoming a standard practice; restocking after logging is done promptly on most lands (figs. 13 and 14); tree genetics projects are underway; foresters are using more sophisticated methods to appraise site quality, select planting stock, and develop management plans; and new methods of animal, insect, and disease control are being tried. These activities may help offset some of the loss of timber production due to forest land conversions.

Whether or not the growing Puget Sound megalopolis ever completely covers the Department's projected Year 2000 Urban Zone, it is probably safe to say that a large portion of the 1,154,000 acres of commercial forest land in it will be converted to nonforest use. Although some of the 12 billion board feet of timber on these lands will undoubtedly be logged and processed in mills and some of the growth on present stands will be utilized, the future forest resource base will be considerably different from today's.

Table 2.— Area by land class and county, Puget Sound area, Washington, January 1, 1967
(In thousand acres)

Land class	All counties	Island	King	Kitsap	Pierce	San Juan	Skagit	Snohomish	Whatcom
Forest:									
Commercial	3,300	80	747	177	575	—	581	693	447
Productive-reserved[1]	504	2	37	10	94	81	56	69	155
Unproductive	1,059	[4]	142	1	89	—	220	253	354
Total	4,863	82	926	188	758	81	857	1,015	956
Nonforest[2]	1,890	54	437	63	315	34	254	328	405
Total area[3]	6,753	136	1,363	251	1,073	115	1,111	1,343	1,361

[1] *Includes 13,000 acres of forest land managed for Christmas tree production. Forest land outside the parks in San Juan County is also included.*

[2] *Includes cropland, pasture and range, swampland, industrial and urban areas, powerline clearings, railroads, and all improved roads and highways, and 58,041 acres classified as water by Forest Survey standards but defined by the Bureau of the Census as land. Also includes 49,000 acres of suburban forest tracts near Seattle.*

[3] *Source: U. S. Bureau of the Census, Land and Water Area of the United States, 1960, revised 1965.*

[4] *Less than 500 acres.*

Table 3. — Area of commercial forest land, by ownership class and county, Puget Sound area, Washington, January 1, 1967

(In thousand acres)

Ownership class	All counties	Island	King	Kitsap	Pierce	Skagit	Snohomish	Whatcom
Public:								
National Forest	748	---	156	---	114	145	222	111
Other Federal	70	---	---	4	45	3	9	9
State	440	3	61	17	40	116	121	82
County and municipal	103	2	71	15	---	4	9	2
Total public	1,361	5	288	36	199	268	361	204
Private:								
Forest industry	910	5	250	28	207	199	118	103
Farmer-owned	277	34	13	---	43	64	57	66
Miscellaneous private — corporate	231	7	104	---	45	18	33	24
Miscellaneous private — noncorporate	521	29	92	113	81	32	124	50
Total private	1,939	75	459	141	376	313	332	243
All ownerships	3,300	80	747	177	575	581	693	447

Table 4. — Area of commercial forest land, by stand-size and ownership class, Puget Sound area, Washington, January 1, 1967

(In thousand acres)

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Sawtimber stands:					
Old growth[1]	628	327	79	174	48
Young growth[2]	1,483	272	309	314	588
Total	2,111	599	388	488	636
Poletimber stands	599	53	117	174	255
Sapling and seedling stands	537	89	93	227	128
Nonstocked areas	53	7	15	21	10
All classes	3,300	748	613	910	1,029

[1] *Stands 140 years and older.*

[2] *Stands less than 140 years old.*

Table 5. — Area of commercial forest land, by stand volume and ownership class, Puget Sound area, Washington, January 1, 1967

(In thousand acres)

Stand volume (board feet per acre[1])	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Less than 1,500	663	102	118	239	204
1,500 to 4,999	398	18	58	147	175
5,000 to 9,999	425	30	77	131	187
10,000 to 19,999	670	46	175	153	296
20,000 to 29,999	280	55	74	37	114
30,000 to 39,999	183	59	43	50	31
40,000 to 49,999	134	66	22	45	1
50,000 or more	547	372	46	108	21
All classes	3,300	748	613	910	1,029

[1] *Net volume, International ¼-inch scale.*

Table 6. — Area of commercial forest land by stocking class of all growing-stock trees and ownership class, Puget Sound area, Washington, January 1, 1967

(In thousand acres)

Stocking percent[1]	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Less than 10	37	7	7	18	5
10-39	151	43	19	56	33
40-69	479	51	95	142	191
70 and over	2,633	647	492	694	800
Total	3,300	748	613	910	1,029

[1] *See "Definition of Terms."*

Table 7. — Area of commercial forest land, by cubic-foot site and ownership classes, Puget Sound area, Washington, January 1, 1967

(In thousand acres)

Site class[1] (cubic feet)	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
225 or more	167	52	21	66	28
165 to 224	619	175	145	199	100
120 to 164	1,196	207	236	326	427
85 to 119	761	149	117	210	285
50 to 84	515	146	76	104	189
20 to 49	42	19	18	5	---
All classes	3,300	748	613	910	1,029

[1] *A classification in terms of capacity for cubic-foot annual growth per acre at culmination of mean annual growth. In general, the cubic-foot site classes can be equated with the Douglas-fir site indexes shown in Technical Bulletin No. 201 (McArdle, Meyer, and Bruce 1961) as follows:*

Cubic-foot site class	Douglas-fir site index value
225 or more	210 and better
165 to 224	170 to 200
120 to 164	130 to 160
85 to 119	110 to 120
50 to 84	80 to 100
20 to 49	below 80

Table 8. — Area of commercial forest land, by forest type and ownership class, Puget Sound area, Washington, January 1, 1967

(In thousand acres)

Forest type	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Douglas-fir	1,018	163	257	236	362
Western hemlock	882	301	125	322	134
Mountain hemlock	54	25	16	13	---
Western redcedar	204	56	48	26	74
Alaska-cedar	15	8	---	7	---
Pacific silver fir	275	152	59	57	7
Noble fir	7	7	---	---	---
Subalpine fir	10	10	---	---	---
Sitka spruce	11	1	10	---	---
Engelmann spruce	1	1	---	---	---
Red alder	542	13	71	173	285
Bigleaf maple	120	2	3	17	98
Black cottonwood	32	---	2	---	30
Other commercial hardwoods[1]	30	---	4	---	26
Noncommercial conifers	5	2	---	3	---
Noncommercial hardwoods	41	---	2	35	4
Nonstocked	53	7	16	21	9
All types	3,300	748	613	910	1,029

[1] *Includes Oregon ash, Oregon white oak, Pacific madrone, and western paper birch.*

Table 9. — Area of noncommercial forest land, by forest type, Puget Sound area, Washington, January 1, 1967

(In thousand acres)

Forest type	All areas	Productive-reserved areas[1]	Unproductive areas
Douglas-fir	177	177[2]	---
Hemlock	97	97	---
Fir-spruce	211	211	---
Lodgepole pine	2	2	---
Cedars	6	6	---
Hardwoods	33	11	22
Unclassified:			
Rocky[3]	803	---	803
Low site[4]	214	---	214
Other[5]	20	---	20
All types	1,563	504	1,059

[1] *Includes forest land capable of growing 20 cubic feet or more per acre per year in the North Cascades and Mount Rainier National Parks; Ross Lake National Recreation Area; Glacier Peak, Pasayten, and Alpine Lakes Wilderness areas; several natural areas; several State and county parks, and forest land outside the parks in San Juan County.*

[2] *Includes 13,000 acres of forest land managed for Christmas tree production.*

[3] *Includes areas that are capable of growing merchantable trees but are too steep and rocky for timber management.*

[4] *Areas stocked with commercial tree species but incapable of growing 20 cubic feet per acre because of soil and climatic factors. In the Puget Sound area low site forest lands are found mostly in the mountains at the upper limits of tree growth (timberline).*

[5] *Includes unstable areas that cannot be logged without seriously affecting the watershed and small isolated patches of commercial forest land on steep mountainsides.*

Table 10. — Volume of growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods, Puget Sound area, Washington, January 1, 1967

Ownership class	Average volume per acre	Total volume		
		All species	Softwoods	Hardwoods
	Cubic feet	*- - - - - Million cubic feet - - - - -*		
All growing stock:				
National Forest	7,778	5,818	5,764	54
Other public	4,026	2,468	2,147	321
Forest industry	3,812	3,469	3,000	469
Farmer and miscellaneous private	2,877	2,960	2,003	957
All ownerships	4,459	14,715	12,914	1,801
	Board feet	*- - - - - Million board feet - - - - -*		
Sawtimber (International ¼-inch scale):				
National Forest	48,580	36,338	36,107	231
Other public	17,287	10,597	9,696	901
Forest industry	17,811	16,208	15,158	1,050
Farmer and miscellaneous private	11,386	11,716	8,790	2,926
All ownerships	22,685	74,859	69,751	5,108
Sawtimber (Scribner scale):				
National Forest	38,848	29,058	28,864	194
Other public	12,677	7,771	6,898	873
Forest industry	13,348	12,147	11,131	1,016
Farmer and miscellaneous private	8,588	8,837	5,993	2,844
All ownerships	17,519	57,813	52,886	4,927

Table 11. Volume of growing stock and sawtimber on commercial forest land by county and ownership class, Puget Sound area, Washington, January 1, 1967

County	Total	National Forest	Other public	Forest industry	Farmer and miscellaneous private
			Million cubic feet		
Growing stock:					
Island	236	---	23	14	199
King	3,541	1,096	522	1,247	676
Kitsap	520	---	113	73	334
Pierce	2,306	913	297	738	358
Skagit	2,586	1,140	463	678	305
Snohomish	3,532	1,874	657	334	667
Whatcom	1,994	795	393	385	421
Total	14,715	5,818	2,468	3,469	2,960
			Million board feet		
Sawtimber (International ¼-inch scale):					
Island	731	---	64	21	646
King	18,443	6,831	2,379	6,302	2,931
Kitsap	2,170	---	407	185	1,578
Pierce	11,706	5,759	1,277	3,438	1,232
Skagit	13,235	7,103	1,685	3,185	1,262
Snohomish	18,508	11,652	3,104	1,250	2,502
Whatcom	10,066	4,993	1,681	1,827	1,565
Total	74,859	36,338	10,597	16,208	11,716
Sawtimber (Scribner scale):					
Island	499	---	41	14	444
King	14,078	5,387	1,748	4,722	2,221
Kitsap	1,553	---	278	135	1,140
Pierce	8,888	4,486	932	2,550	920
Skagit	10,364	5,775	1,179	2,416	994
Snohomish	14,614	9,383	2,334	963	1,934
Whatcom	7,817	4,027	1,259	1,347	1,184
Total	57,813	29,058	7,771	12,147	8,837

Table 12. — Number of growing-stock trees on commercial forest land, by diameter class and by softwoods and hardwoods, Puget Sound area, Washington, January 1, 1967

(Thousands of trees)

Diameter class (inches at breast height)	All species	Softwoods	Hardwoods
5.0-6.9	180,803	132,832	47,971
7.0-8.9	118,673	83,503	35,170
9.0-10.9	79,472	54,483	24,989
11.0-12.9	51,729	37,614	14,115
13.0-14.9	33,977	25,762	8,215
15.0-16.9	23,997	19,294	4,703
17.0-18.9	15,886	13,811	2,075
19.0-20.9	10,058	9,294	764
21.0-28.9	21,312	20,383	929
29.0-38.9	9,215	9,029	186
39.0 and larger	4,093	4,044	49
All classes	549,215	410,049	139,166

Table 13. — Average number of growing-stock trees per acre on commercial forest land, by diameter and ownership class, Puget Sound area, Washington, January 1, 1967

Diameter class (inches at breast height)	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
5.0-6.9	55	37	74	52	58
7.0-8.9	36	25	47	40	35
9.0-10.9	24	16	32	24	25
11.0-12.9	16	12	20	14	17
13.0-14.9	10	10	12	10	10
15.0-16.9	7	8	9	6	7
17.0-18.9	5	6	5	3	5
19.0-20.9	3	5	3	3	2
21.0-28.9	6	13	5	5	4
29.0-38.9	3	7	1	2	1
39.0 and larger	1	4	---	1	---
All classes	166	143	208	160	164

Table 14. — Number of growing-stock trees on commercial forest land, by species and diameter class, Puget Sound area, Washington, January 1, 1967

(Thousands of trees)

Species	Diameter class (inches at breast height)											
	All classes	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:												
Douglas-fir	145,665	42,344	31,002	21,036	15,145	10,685	7,991	5,381	3,331	6,078	1,800	872
Western hemlock	143,913	50,488	28,894	20,594	12,157	7,840	5,583	3,758	2,843	6,663	3,328	1,765
Mountain hemlock	6,825	1,258	823	594	644	679	542	688	375	742	414	66
Western redcedar	55,210	20,569	12,045	6,380	5,363	2,865	1,954	1,514	863	1,967	950	740
Alaska-cedar	2,259	208	256	197	272	180	281	118	218	335	147	47
Pacific silver fir	50,147	16,076	9,628	5,283	3,472	2,996	2,631	2,141	1,420	3,989	2,070	441
Grand fir	837	49	278	---	179	214	53	15	15	15	15	4
Noble fir	1,709	440	253	77	54	63	61	48	111	307	204	91
Subalpine fir	1,294	265	248	123	88	123	128	114	80	110	15	---
Sitka spruce	1,274	762	---	---	127	71	50	16	24	142	65	17
Engelmann spruce	37	---	11	---	---	6	8	3	---	3	6	---
Lodgepole pine	153	11	---	139	3	---	---	---	---	---	---	---
Western white pine	712	348	65	60	110	40	12	15	14	32	15	1
Whitebark pine	14	14	---	---	---	---	---	---	---	---	---	---
Total	410,049	132,832	83,503	54,483	37,614	25,762	19,294	13,811	9,294	20,383	9,029	4,044
Hardwoods:												
Red alder	105,418	35,501	27,978	19,938	10,802	6,389	3,109	1,036	264	401	---	---
Bigleaf maple	23,962	8,935	4,660	3,910	2,587	1,364	1,139	565	332	331	111	28
Black cottonwood	3,394	403	670	310	466	411	394	364	136	147	72	21
Other hardwoods[1]	6,392	3,132	1,862	831	260	51	61	110	32	50	3	---
Total	139,166	47,971	35,170	24,989	14,115	8,215	4,703	2,075	764	929	186	49
All species	549,215	180,803	118,673	79,472	51,729	33,977	23,997	15,886	10,058	21,312	9,215	4,093

[1] *Included are Oregon ash, Oregon white oak, Pacific madrone, and western paper birch.*

Table 15. — Volume of timber on commercial forest land, by class of timber and by softwoods and hardwoods, Puget Sound area, Washington, January 1, 1967

(In million cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Saw-log portion	11,449	10,696	753
Upper-stem portion	622	404	218
Total	12,071	11,100	971
Poletimber trees	2,644	1,814	830
All growing-stock trees	14,715	12,914	1,801
Sound cull trees	128	36	92
Rotten cull trees	141	132	9
Salvable dead trees, sawtimber-size	447	430	17
Total, all timber	15,431	13,512	1,919

Table 16. – Volume of growing stock and sawtimber on commercial forest land, by stand-size class and by softwoods and hardwoods, Puget Sound area, Washington, January 1, 1967

Stand-size class	Average volume per acre	All species	Softwoods	Hardwoods
	Cubic feet	*- - - - - Million cubic feet - - - - -*		
All growing stock :				
Sawtimber stands	3,984	13,147	11,874	1,273
Poletimber stands	400	1,320	833	487
Sapling and seedling stands and nonstocked areas	75	248	207	41
Total	4,459	14,715	12,914	1,801
	Board feet	*- - - - - Million board feet - - - - -*		
Sawtimber (International ¼-inch scale):				
Sawtimber stands	21,849	72,101	67,610	4,491
Poletimber stands	670	2,209	1,634	575
Sapling and seedling stands and nonstocked areas	166	549	507	42
Total	22,685	74,859	69,751	5,108
Sawtimber (Scribner scale):				
Sawtimber stands	16,927	55,860	51,529	4,331
Poletimber stands	480	1,585	1,030	555
Sapling and seedling stands and nonstocked areas	112	368	327	41
Total	17,519	57,813	52,886	4,927

Table 17. — Volume of growing stock on commercial forest land, by species and county, Puget Sound area, Washington, January 1, 1967
(In million cubic feet)

Species	Total	Island	King	Kitsap	Pierce	Skagit	Snohomish	Whatcom
Softwoods:								
Douglas-fir	4,126	145	932	344	902	594	743	466
Western hemlock	4,537	34	1,199	46	793	843	1,080	542
Mountain hemlock	345	---	90	---	10	67	147	31
Western redcedar	1,311	4	195	28	95	326	412	251
Alaska-cedar	118	---	17	---	4	8	31	58
Pacific silver fir	2,156	---	575	---	226	401	577	377
Grand fir	25	2	[1]	---	1	19	3	---
Noble fir	177	---	120	---	53	---	4	---
Subalpine fir	36	---	8	---	22	2	---	4
Sitka spruce	60	2	36	---	[1]	1	15	6
Engelmann spruce	3	---	---	---	1	2	---	---
Lodgepole pine	2	---	---	2	[1]	---	---	---
Western white pine	18	[1]	4	4	3	1	4	2
Total	12,914	187	3,176	424	2,110	2,264	3,016	1,737
Hardwoods:								
Red alder	1,289	47	258	85	156	184	395	164
Bigleaf maple	349	2	87	11	23	100	76	50
Black cottonwood	114	---	18	---	8	36	40	12
Other hardwoods[2]	49	---	2	---	9	2	5	31
Total	1,801	49	365	96	196	322	516	257
All species	14,715	236	3,541	520	2,306	2,586	3,532	1,994

[1] *Less than 500,000 cubic feet.*

[2] *Includes Oregon ash, Oregon white oak, Pacific madrone, and western paper birch.*

Table 18. — Volume of sawtimber on commercial forest land, by species and county, Puget Sound area, Washington, January 1, 1967 (International ¼-inch scale)

(In million board feet)

Species	Total	Island	King	Kitsap	Pierce	Skagit	Snohomish	Whatcom
Softwoods:								
Douglas-fir	21,013	495	4,776	1,616	4,364	3,374	4,154	2,234
Western hemlock	24,305	75	6,457	192	4,542	4,494	5,594	2,951
Mountain hemlock	2,070	---	534	---	60	389	905	182
Western redcedar	6,736	16	1,002	85	438	1,621	2,220	1,354
Alaska-cedar	656	---	95	---	18	40	184	319
Pacific silver fir	12,991	---	3,575	---	1,344	2,214	3,585	2,273
Grand fir	132	12	---	---	4	90	26	---
Noble fir	1,175	---	790	---	361	---	24	---
Subalpine fir	185	---	37	---	107	13	---	28
Sitka spruce	369	11	235	---	---	5	82	36
Engelmann spruce	19	---	---	---	7	12	---	---
Lodgepole pine	[1]	---	---	---	[1]	---	---	---
Western white pine	100	1	22	11	18	9	27	12
Total	69,751	610	17,523	1,904	11,263	12,261	16,801	9,389
Hardwoods:								
Red alder	3,111	112	501	217	295	432	1,176	378
Bigleaf maple	1,259	9	293	49	62	335	307	204
Black cottonwood	655	---	126	---	55	204	225	45
Other hardwoods[2]	83	---	---	---	31	3	---	49
Total	5,108	121	920	266	443	974	1,708	676
All species	74,859	731	18,443	2,170	11,706	13,235	18,509	10,065

[1] *Less than 500,000 board feet.*

[2] *Includes Oregon ash, Pacific madrone, and western paper birch.*

Table 19. – Volume of growing stock on commercial forest land, by species and ownership class, Puget Sound area, Washington, January 1, 1967

(In million cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	4,126	1,253	901	820	1,152
Western hemlock	4,537	2,148	559	1,347	483
Mountain hemlock	345	185	68	92	---
Western redcedar	1,311	610	251	205	245
Alaska-cedar	118	54	8	56	---
Pacific silver fir	2,156	1,359	311	406	80
Grand fir	25	3	8	3	11
Noble fir	177	97	22	58	---
Subalpine fir	36	36	---	---	---
Sitka spruce	60	4	17	13	26
Engelmann spruce	3	3	---	---	---
Lodgepole pine	2	[1]	---	---	2
Western white pine	18	12	2	---	4
Total	12,914	5,764	2,147	3,000	2,003
Hardwoods:					
Red alder	1,289	38	245	356	650
Bigleaf maple	349	14	48	85	202
Black cottonwood	114	2	22	26	64
Other hardwoods[2]	49	---	6	2	41
Total	1,801	54	321	469	957
All species	14,715	5,818	2,468	3,469	2,960

[1] *Less than 500,000 cubic feet.*

[2] *Includes Oregon ash, Oregon white oak, Pacific madrone, and western paper birch.*

Table 20. — Volume of sawtimber on commercial forest land by species and ownership class, Puget Sound area, Washington, January 1, 1967 (International ¼-inch scale)
(In million board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	21,013	8,008	4,012	3,894	5,099
Western hemlock	24,305	13,295	2,246	6,747	2,017
Mountain hemlock	2,070	1,175	383	512	---
Western redcedar	6,736	3,888	925	893	1,030
Alaska-cedar	656	314	35	307	---
Pacific silver fir	12,991	8,421	1,807	2,326	437
Grand fir	132	26	40	16	50
Noble fir	1,175	659	137	379	---
Subalpine fir	185	185	---	---	---
Sitka spruce	369	33	106	84	146
Engelmann spruce	19	19	---	---	---
Lodgepole pine	[1]	[1]	---	---	---
Western white pine	100	84	5	---	11
Total	69,751	36,107	9,696	15,158	8,790
Hardwoods:					
Red alder	3,111	142	642	705	1,622
Bigleaf maple	1,259	69	143	215	832
Black cottonwood	655	20	101	130	404
Other hardwoods[2]	83	---	15	---	68
Total	5,108	231	901	1,050	2,926
All species	74,859	36,338	10,597	16,208	11,716

[1] *Less than 500,000 board feet.*

[2] *Includes Oregon ash, Pacific madrone, and western paper birch.*

Table 21. — Volume of growing stock on commercial forest land, by species and diameter class, Puget Sound area, Washington, January 1, 1967
(In million cubic feet)

Species	Diameter class (inches at breast height)											
	All classes	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 & larger
Softwoods:												
Douglas-fir	4,126	164	244	292	337	345	359	326	261	751	481	566
Western hemlock	4,537	191	222	284	268	258	259	232	225	856	878	864
Mountain hemlock	345	4	6	5	11	22	21	40	27	83	83	43
Western redcedar	1,311	64	72	64	86	65	63	66	47	180	177	427
Alaska-cedar	118	1	3	2	3	3	9	4	12	34	31	16
Pacific silver fir	2,156	51	63	69	78	105	130	144	123	566	592	235
Grand fir	25	[1]	2	---	4	7	3	1	1	1	4	2
Noble fir	177	[1]	2	1	1	2	3	4	10	45	59	50
Subalpine fir	36	[1]	2	1	1	4	5	5	5	10	3	---
Sitka spruce	60	3	---	---	3	2	3	1	2	18	18	10
Engelmann spruce	3	---	[1]	---	[1]	[1]	[1]	[1]	---	1	2	---
Lodgepole pine	2	[1]	---	2	---	---	---	---	---	---	---	---
Western white pine	18	1	[1]	1	3	1	[1]	1	2	4	4	1
Total	12,914	479	616	721	795	814	855	824	715	2,549	2,332	2,214
Hardwoods:												
Red alder	1,289	151	233	276	224	189	119	53	16	28	---	---
Bigleaf maple	349	38	39	48	50	37	38	25	19	31	18	6
Black cottonwood	114	1	6	4	9	13	17	19	9	16	12	8
Other hardwoods[2]	49	11	12	10	4	1	2	5	1	3	---	---
Total	1,801	201	290	338	287	240	176	102	45	78	30	14
All species	14,715	680	906	1,059	1,082	1,054	1,031	926	760	2,627	2,362	2,228

[1] *Less than 500,000 cubic feet.*

[2] *Includes Pacific madrone, western paper birch, Oregon white oak, and Oregon ash.*

Table 22. — Volume of sawtimber on commercial forest land, by species and diameter class, Puget Sound area, Washington, January 1, 1967 (International ¼-inch scale)

(In million board feet)

Species	Diameter class (inches at breast height)								
	All classes	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:									
Douglas-fir	21,013	1,512	1,755	1,976	1,912	1,603	4,923	3,327	4,005
Western hemlock	24,305	1,292	1,373	1,473	1,377	1,410	5,566	5,953	5,861
Mountain hemlock	2,070	55	107	131	229	153	533	564	298
Western redcedar	6,736	361	310	324	346	268	1,058	1,192	2,877
Alaska-cedar	656	20	19	48	30	67	195	177	100
Pacific silver fir	12,991	378	569	756	878	784	3,833	4,116	1,677
Grand fir	132	16	37	16	7	7	11	21	17
Noble fir	1,175	5	10	17	18	60	302	409	354
Subalpine fir	185	6	14	23	30	28	67	17	---
Sitka spruce	369	15	12	16	7	11	115	122	71
Engelmann spruce	19	---	1	3	1	---	---	8	6
Lodgepole pine	[1]	[1]	---	---	---	---	---	---	---
Western white pine	100	14	7	4	6	7	31	25	6
Total	69,751	3,674	4,214	4,787	4,841	4,398	16,634	15,931	15,272
Hardwoods:									
Red alder	3,111	986	910	632	303	95	185	---	---
Bigleaf maple	1,259	214	174	192	143	105	228	140	63
Black cottonwood	655	39	65	92	106	61	108	105	79
Other hardwoods[2]	83	20	2	8	28	6	19	---	---
Total	5,108	1,259	1,151	924	580	267	540	245	142
All species	74,859	4,933	5,365	5,711	5,421	4,665	17,174	16,176	15,414

[1] *Less than 500,000 board feet.*

[2] *Includes Pacific madrone, western paper birch, and Oregon ash.*

Table 23. — Volume of sawtimber on commercial forest land, by species and diameter class, Puget Sound area, Washington, January 1, 1967 (Scribner scale)

(In million board feet)

Species	Diameter class (inches at breast height)								
	All classes	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:									
Douglas-fir	15,559	858	1,072	1,283	1,303	1,137	3,724	2,731	3,451
Western hemlock	18,563	741	846	961	945	1,006	4,248	4,856	4,960
Mountain hemlock	1,542	30	64	83	153	108	397	455	252
Western redcedar	5,129	198	175	199	218	177	743	938	2,481
Alaska-cedar	472	10	11	29	21	43	138	137	83
Pacific silver fir	10,091	222	359	505	616	573	2,990	3,409	1,417
Grand fir	91	9	22	10	5	6	9	16	14
Noble fir	941	3	6	11	12	43	232	334	300
Subalpine fir	135	4	11	17	21	20	49	13	---
Sitka spruce	275	8	6	11	5	7	85	98	55
Engelmann spruce	14	---	[1]	1	1	---	2	10	---
Lodgepole pine	[1]	[1]	---	---	---	---	---	---	---
Western white pine	74	8	5	2	5	5	22	22	5
Total	52,886	2,091	2,577	3,112	3,305	3,125	12,639	13,019	13,018
Hardwoods:									
Red alder	2,993	944	875	610	292	92	180	---	---
Bigleaf maple	1,214	203	167	183	133	103	223	139	63
Black cottonwood	638	36	63	88	102	58	107	105	79
Other hardwoods[2]	82	19	2	8	28	7	18	---	---
Total	4,927	1,202	1,107	889	555	260	528	244	142
All species	57,813	3,293	3,684	4,001	3,860	3,385	13,167	13,263	13,160

[1] *Less than 500,000 board feet.*

[2] *Includes Pacific madrone, western paper birch, and Oregon ash.*

Table 24. — Area of commercial forest land and volume of growing stock and sawtimber, by stand age and ownership classes, Puget Sound area, Washington, January 1, 1967

Stand age (years)	All ownerships			National Forest			Other public			Forest industry			Farmer and miscellaneous private		
	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber
		Million cubic feet	*Million board feet*[1]		*Million cubic feet*	*Million board feet*[1]		*Million cubic feet*	*Million board feet*[1]		*Million cubic feet*	*Million board feet*[1]		*Million cubic feet*	*Million board feet*[1]
Nonstocked[2]	53	5	---	7	[3]	--	15	3	---	21	2	---	10	---	---
0 - 9	299	98	244	12	11	60	34	5	27	139	44	95	84	38	62
10 - 19	239	188	317	38	8	10	41	18	14	92	77	172	68	85	121
20 - 29	343	633	1,396	13	12	37	71	133	241	125	236	595	134	252	523
30 - 39	523	1,789	5,592	15	25	56	151	542	1,755	166	618	1,766	191	604	2,015
40 - 49	403	1,603	5,900	30	86	255	121	542	1,851	78	334	1,222	174	641	2,572
50 - 59	133	574	2,599	15	67	256	14	104	486	27	118	692	77	255	1,165
60 - 69	84	381	1,752	15	79	382	18	99	464	9	9	29	42	194	877
70 - 79	60	200	933	6	38	183	7	40	203	6	7	6	41	115	541
80 - 89	40	276	1,346	11	78	378	3	19	95	15	114	515	8	65	358
90 - 99	10	60	346	4	19	95	4	12	69	2	29	182	---	---	---
100 - 109	19	153	857	14	106	590	4	34	210	---	---	---	1	13	57
110 - 119	19	144	833	12	85	483	---	---	---	5	51	311	2	8	39
120 - 129	14	97	545	11	67	351	2	15	95	---	---	---	1	15	99
130 - 159	32	270	1,679	27	229	1,429	3	14	85	2	27	165	---	---	---
160 - 199	48	430	2,665	43	385	2,406	---	---	---	---	---	---	5	45	259
200 and over	508	5,308	34,141	358	3,795	24,943	42	377	2,250	97	1,020	6,206	11	116	742
Uneven-aged under 100 years	269	1,004	1,452	22	142	404	49	228	1,128	50	242	1,305	148	392	1,615
Uneven-aged over 100 years	204	1,502	9,262	62	586	4,020	34	283	1,624	76	511	2,947	32	122	671
All ages	3,300	14,715	74,859	748	5,818	36,338	613	2,468	10,597	910	3,469	16,208	1,029	2,960	11,716

[1] *International 1/4-inch scale*

[2] *See "Definition of Terms."*

[3] *Less than 500,000 cubic feet*

Table 25. — Net annual growth of growing stock on commercial forest land, by species and ownership class, Puget Sound area, Washington, 1966[1]
(In thousand cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	108,800	8,200	28,800	24,200	47,600
Western hemlock	76,700	6,800	20,000	31,900	18,000
Western redcedar	25,900	3,400	13,400	[2] -2,800	11,900
True firs	10,500	2,200	3,300	4,100	900
Other softwoods[3]	13,500	[2] -2,600	[2] -1,300	17,400	[4]
Total	235,400	18,000	64,200	74,800	78,400
Hardwoods:					
Red alder	42,600	900	7,700	12,500	21,500
Other hardwoods[5]	20,500	300	3,100	5,700	11,400
Total	63,100	1,200	10,800	18,200	32,900
All species	298,500	19,200	75,000	93,000	111,300

[1] *See "Inventory Procedures" for an explanation of growth estimates and the actual periods over which growth was measured.*

[2] *Negative growth is the result of mortality exceeding gross annual growth.*

[3] *Includes Sitka spruce, Engelmann spruce, Alaska-cedar, mountain hemlock, lodgepole pine, and western white pine.*

[4] *Less than 50,000 cubic feet.*

[5] *Includes bigleaf maple, black cottonwood, Pacific madrone, western paper birch, Oregon white oak, and Oregon ash.*

Table 26. — Net annual growth of sawtimber on commercial forest land, by species and ownership class, Puget Sound area, Washington, 1966[1] (International ¼-inch scale)
(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	566,400	52,200	164,400	101,900	247,900
Western hemlock	356,700	28,200	69,300	168,400	90,800
Western redcedar	106,000	25,000	59,600	[2] -35,100	56,500
True firs	57,200	10,500	17,000	24,500	5,200
Other softwoods[3]	90,500	[2] -14,700	[2] -2,500	107,100	600
Total	1,176,800	101,200	307,800	366,800	401,000
Hardwoods:					
Red alder	104,200	10,700	19,400	25,400	48,700
Other hardwoods[4]	77,700	3,500	9,700	16,200	48,300
Total	181,900	14,200	29,100	41,600	97,000
All species	1,358,700	115,400	336,900	408,400	498,000

[1] *See "Inventory Procedures" for an explanation of growth estimates and the actual periods over which growth was measured.*

[2] *Negative growth is the result of mortality exceeding gross annual growth.*

[3] *Includes Sitka spruce, Engelmann spruce, Alaska-cedar, mountain hemlock, lodgepole pine, and western white pine.*

[4] *Includes bigleaf maple, black cottonwood, Pacific madrone, western paper birch, and Oregon ash.*

Table 27.— Net annual growth of sawtimber on commercial forest land, by species and ownership class, Puget Sound area, Washington, 1966[1] *(Scribner scale)*
(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	401,400	41,400	115,100	72,000	172,900
Western hemlock	234,300	21,600	41,100	111,100	60,500
Western redcedar	52,900	18,800	34,000	[2] -37,400	37,500
True firs	46,100	7,700	13,900	20,300	4,200
Other softwoods[3]	73,000	[2] -10,800	[2] -1,000	83,900	900
Total	807,700	78,700	203,100	249,900	276,000
Hardwoods:					
Red alder	98,200	7,100	18,900	24,800	47,400
Other hardwoods[4]	75,500	2,300	9,700	15,900	47,600
Total	173,700	9,400	28,600	40,700	95,000
All species	981,400	88,100	231,700	290,600	371,000

[1] *See "Inventory Procedures" for an explanation of growth estimates and the actual periods over which growth was measured.*

[2] *Negative growth is the result of mortality exceeding gross annual growth.*

[3] *Includes Sitka spruce, Engelmann spruce, Alaska-cedar, mountain hemlock, lodgepole pine, and western white pine.*

[4] *Includes bigleaf maple, black cottonwood, Pacific madrone, western paper birch, and Oregon ash.*

Table 28. — Net annual growth of growing stock on commercial forest land, by species and county, Puget Sound area, Washington, 1966[1]
(In thousand cubic feet)

Species	County							
	All counties	Island	King	Kitsap	Pierce	Skagit	Snohomish	Whatcom
Softwoods:								
Douglas-fir	108,800	7,000	22,000	13,100	22,900	14,100	17,600	12,100
Western hemlock	76,700	1,600	19,800	1,600	10,100	15,700	20,300	7,600
Western redcedar	25,900	700	3,800	1,100	[2] -4,100	10,300	9,900	4,200
True fir	10,500	100	4,300	---	500	3,000	3,700	[2] -1,100
Other softwoods[3]	13,500	[4]	5,100	100	[4]	300	[2] -1,600	9,600
Total	235,400	9,400	55,000	15,900	29,400	43,400	49,900	32,400
Hardwoods:								
Red alder	42,600	1,600	10,300	1,200	5,400	6,100	11,700	6,300
Other hardwoods[5]	20,500	100	4,800	[4]	1,500	6,300	4,200	3,600
Total	63,100	1,700	15,100	1,200	6,900	12,400	15,900	9,900
All species	298,500	11,100	70,100	17,100	36,300	55,800	65,800	42,300

[1] *See "Inventory Procedures" for an explanation of growth estimates and the actual periods over which growth was measured.*

[2] *Negative growth is the result of mortality exceeding gross annual growth.*

[3] *Includes Sitka spruce, Engelmann spruce, Alaska-cedar, mountain hemlock, lodgepole pine, and western white pine.*

[4] *Less than 50,000 cubic feet.*

[5] *Includes bigleaf maple, black cottonwood, Pacific madrone, western paper birch, Oregon white oak, and Oregon ash.*

Table 29. — Net annual growth of sawtimber on commercial forest land, by species and county, Puget Sound area, Washington, 1966[1] (International ¼-inch scale) (In thousand board feet)

Species	County							
	All counties	Island	King	Kitsap	Pierce	Skagit	Snohomish	Whatcom
Softwoods:								
Douglas-fir	566,400	37,300	93,700	72,800	95,900	90,000	97,100	79,600
Western hemlock	356,700	3,400	85,000	7,200	65,600	69,100	112,300	14,100
Western redcedar	106,000	200	22,800	14,800	[2]-31,800	44,800	40,000	15,200
True firs	57,200	400	29,500	---	1,100	11,200	23,600	[2]-8,600
Other softwoods[3]	90,500	500	29,800	[2]-100	[2]-1,200	4,500	[2]-5,000	62,000
Total	1,176,800	41,800	260,800	94,700	129,600	219,600	268,000	162,300
Hardwoods:								
Red alder	104,200	4,100	17,800	4,600	9,200	15,900	40,500	12,100
Other hardwoods[4]	77,700	400	16,900	700	5,100	25,300	18,600	10,700
Total	181,900	4,500	34,700	5,300	14,300	41,200	59,100	22,800
All species	1,358,700	46,300	295,500	100,000	143,900	260,800	327,100	185,100

[1] *See "Inventory Procedures" for an explanation of growth estimates and the actual periods over which growth was measured.*

[2] *Negative growth is the result of mortality exceeding gross annual growth.*

[3] *Includes Sitka spruce, Engelmann spruce, Alaska-cedar, mountain hemlock, lodgepole pine, and western white pine.*

[4] *Includes bigleaf maple, black cottonwood, Pacific madrone, western paper birch, and Oregon ash.*

Table 30. — Average annual mortality of growing stock on commercial forest land, by species and ownership class, Puget Sound area, Washington, 1966[1]
(In thousand cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	14,200	4,700	3,000	2,700	3,800
Western hemlock	26,400	12,300	5,600	6,800	1,700
Western redcedar	14,100	1,600	1,100	10,000	1,400
True firs	15,100	12,700	900	1,500	[2]
Other softwoods[3]	5,700	2,900	800	1,000	1,000
Total	75,500	34,200	11,400	22,000	7,900
Hardwoods:					
Red alder	7,700	200	700	2,500	4,300
Other hardwoods[4]	3,000	100	600	600	1,700
Total	10,700	300	1,300	3,100	6,000
All species	86,200	34,500	12,700	25,100	13,900

[1] *See "Inventory Procedures" for details on the mortality estimates and periods over which mortality was estimated.*

[2] *Less than 50,000 cubic feet.*

[3] *Includes Sitka spruce, Engelmann spruce, Alaska-cedar, mountain hemlock, lodgepole pine, and western white pine.*

[4] *Includes bigleaf maple, black cottonwood, Pacific madrone, western paper birch, Oregon white oak, and Oregon ash.*

Table 31. — Average annual mortality of sawtimber on commercial forest land, by species and ownership class, Puget Sound area, Washington, 1966[1] *(International ¼-inch scale)*
(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	65,300	30,500	8,700	10,100	16,000
Western hemlock	145,600	79,200	31,200	31,200	4,000
Western redcedar	74,400	9,500	5,300	55,400	4,200
True firs	90,500	78,600	5,300	6,200	400
Other softwoods[2]	30,700	17,300	3,100	5,700	4,600
Total	406,500	215,100	53,600	108,600	29,200
Hardwoods:					
Red alder	12,200	900	1,900	2,500	6,900
Other hardwoods[3]	10,900	1,000	3,300	1,900	4,700
Total	23,100	1,900	5,200	4,400	11,600
All species	429,600	217,000	58,800	113,000	40,800

[1] *See "Inventory Procedures" for details on the mortality estimates and periods over which mortality was estimated.*

[2] *Includes Sitka spruce, Engelmann spruce, Alaska-cedar, mountain hemlock, lodgepole pine, and western white pine.*

[3] *Includes bigleaf maple, black cottonwood, Pacific madrone, western paper birch, and Oregon ash.*

Table 32. — Average annual mortality of sawtimber on commercial forest land, by species and ownership class, Puget Sound area, Washington, 1966[1] *(Scribner scale)*
(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	51,200	25,700	6,400	7,200	11,900
Western hemlock	114,500	64,500	23,700	23,800	2,500
Western redcedar	66,700	8,000	4,000	51,000	3,700
True firs	72,200	63,700	4,000	4,400	100
Other softwoods[2]	22,100	13,100	2,100	3,800	3,100
Total	326,700	175,000	40,200	90,200	21,300
Hardwoods:					
Red alder	12,000	800	1,800	2,500	6,900
Other hardwoods[3]	10,400	900	3,200	1,800	4,500
Total	22,400	1,700	5,000	4,300	11,400
All species	349,100	176,700	45,200	94,500	32,700

[1] *See "Inventory Procedures" for details on the mortality estimates and periods over which mortality was estimated.*

[2] *Includes Sitka spruce, Engelmann spruce, Alaska-cedar, mountain hemlock, lodgepole pine, and western white pine.*

[3] *Includes bigleaf maple, black cottonwood, Pacific madrone, western paper birch, Oregon white oak, and Oregon ash.*

Table 33. — Average annual mortality of growing stock on commercial forest land, by species and county, Puget Sound area, Washington, 1966[1]
(In thousand cubic feet)

Species	County							
	All counties	Island	King	Kitsap	Pierce	Skagit	Snohomish	Whatcom
Softwoods:								
Douglas-fir	14,200	700	2,100	600	5,900	600	2,700	1,600
Western hemlock	26,400	200	7,300	300	4,600	4,000	5,000	5,000
Western redcedar	14,100	300	2,400	100	7,100	800	2,000	1,400
True firs	15,100	---	1,900	---	2,000	4,300	2,500	4,400
Other softwoods[2]	5,700	---	2,400	300	1,600	---	1,000	400
Total	75,500	1,200	16,100	1,300	21,200	9,700	13,200	12,800
Hardwoods:								
Red alder	7,700	200	1,300	1,200	1,000	1,100	2,200	700
Other hardwoods[3]	3,000	---	400	300	300	800	800	400
Total	10,700	200	1,700	1,500	1,300	1,900	3,000	1,100
All species	86,200	1,400	17,800	2,800	22,500	11,600	16,200	13,900

[1] *See "Inventory Procedures" for details on the mortality estimates and periods over which mortality was estimated.*

[2] *Includes Sitka spruce, Engelmann spruce, Alaska-cedar, mountain hemlock, lodgepole pine, and western white pine.*

[3] *Includes bigleaf maple, black cottonwood, Pacific madrone, western paper birch, Oregon white oak, and Oregon ash.*

Table 34. — Average annual mortality of sawtimber on commercial forest land, by species and county, Puget Sound area, Washington, 1966[1] (International ¼-inch scale) (In thousand board feet)

Species	County							
	All counties	Island	King	Kitsap	Pierce	Skagit	Snohomish	Whatcom
Softwoods:								
Douglas-fir	65,300	2,900	11,800	1,400	22,700	2,800	13,800	9,900
Western hemlock	145,600	600	39,700	1,600	25,400	20,700	25,800	31,800
Western redcedar	74,400	600	8,800	400	44,300	3,500	8,600	8,200
True firs	90,500	---	11,600	---	12,800	23,600	13,400	29,100
Other softwoods[2]	30,700	---	13,900	700	7,500	400	5,800	2,400
Total	406,500	4,100	85,800	4,100	112,700	51,000	67,400	81,400
Hardwoods:								
Red alder	12,200	---	2,100	1,500	900	2,200	4,100	1,400
Other hardwoods[3]	10,900	---	400	1,600	900	2,900	3,500	1,600
Total	23,100	---	2,500	3,100	1,800	5,100	7,600	3,000
All species	429,600	4,100	88,300	7,200	114,500	56,100	75,000	84,400

[1] *See "Inventory Procedures" for details on the mortality estimates and periods over which mortality was estimated.*

[2] *Includes Sitka spruce, Engelmann spruce, Alaska-cedar, mountain hemlock, lodgepole pine, and western white pine.*

[3] *Includes bigleaf maple, black cottonwood, Pacific madrone, western paper birch, and Oregon ash.*

Table 35. — Average annual mortality of growing stock and sawtimber on commercial forest land, by cause of death and by softwoods and hardwoods, Puget Sound area, Washington, 1966

Species	Cause of death					
	All causes	Fire	Insects	Disease	Other[1]	Miscellaneous and unknown[2]
			- - - - - Thousand cubic feet - - - - -			
Growing stock:						
Softwoods	75,500	1,000	1,900	8,900	45,400	18,300
Hardwoods	10,700	---	---	400	6,200	4,100
Total	86,200	1,000	1,900	9,300	51,600	22,400
			- - - - - Thousand board feet, International ¼-inch scale - - - - -			
Sawtimber:						
Softwoods	406,500	6,200	11,800	51,100	239,000	98,400
Hardwoods	23,100	---	---	600	12,700	9,800
Total	429,600	6,200	11,800	51,700	251,700	108,200
			- - - - - Thousand board feet, Scribner scale - - - - -			
Sawtimber:						
Softwoods	326,700	5,000	9,500	42,700	188,500	81,000
Hardwoods	22,400	---	---	600	12,400	9,400
Total	349,100	5,000	9,500	43,300	200,900	90,400

[1] *Mostly weather killed, some of which had been predisposed to windbreak or windthrow by root rot, heart rot, and by the opening of stands by logging and road building. A rather small volume of timber in this group was killed by animals, suppression, and natural mechanical agents such as rockslides and falling snags.*

[2] *Includes hemlock dieback.*

Table 36. — Net volume of salvable dead sawtimber on commercial forest land, by volume-per-acre class and owner group, Puget Sound area, Washington, January 1, 1967

Volume-per-acre class	Total	National Forest	All other owners
		- - - - - Thousand cubic feet - - - - -	
Cubic feet:			
1 - 199	23,600	16,100	7,500
200 - 499	109,000	43,000	66,000
500 - 999	118,500	67,900	50,600
1,000 - 1,999	106,800	63,100	43,700
2,000 or more	88,900	47,400	41,500
Total	446,800	237,500	209,300
		- - - - - Thousand board feet, International ¼-inch scale - - - - -	
Board feet:			
1 - 499	16,400	16,400	---
500 - 999	89,600	56,200	33,400
1,000 - 2,499	487,400	193,800	293,600
2,500 - 4,999	619,400	346,700	272,700
5,000 - 9,999	710,200	461,200	249,000
10,000 or more	902,600	490,000	412,600
Total	2,825,600	1,564,300	1,261,300

Table 37. — Net volume of salvable dead sawtimber on commercial forest land, by volume-per-tree class and species group, Puget Sound area, Washington, January 1, 1967

Volume-per-acre class	Total	Douglas-fir	Hemlock	Cedar	True firs	Other softwoods	Hardwoods
			- - - - - Thousand cubic feet - - - - -				
Cubic feet:							
1 - 49	73,300	16,200	21,900	11,000	13,700	2,600	7,900
50 - 99	88,800	15,000	21,100	10,800	19,200	14,200	8,500
100 - 499	228,300	23,400	89,800	33,200	72,300	9,000	600
500 or more	56,400	12,600	13,900	21,400	8,500	---	---
Total	446,800	67,200	146,700	76,400	113,700	25,800	17,000
			- - - - - Thousand board feet, International ¼-inch scale - - - - -				
Board feet:							
1 - 149	175,900	37,700	49,000	27,900	31,400	7,700	22,200
150 - 499	563,700	116,900	128,900	70,700	124,200	59,100	63,900
500 - 2,499	1,444,300	138,300	550,300	186,400	474,700	83,300	11,300
2,500 or more	641,700	135,600	211,700	172,900	121,500	---	---
Total	2,825,600	428,500	939,900	457,900	751,800	150,100	97,400

Table 38. — Timber harvest by ownership class, Puget Sound area, Washington, 1950-68 (International ¼-inch scale)
(In thousand board feet)

Year	All ownerships			Private[1]			State[1]			National Forest			Other public		
	Total	Live	Dead[2]	Total	Live	Dead[2]	Total	Live	Dead[2]	Total	Live	Dead[2]	Total	Live	Dead[2]
1950	1,368,209	[4]	[4]				1,112,437	[3]	[3]	218,668	[3]	[3]	37,104	[3]	[3]
1951	1,319,901	[4]	[3]				1,054,043	[4]	[3]	259,504	[3]	[3]	6,354	[3]	[3]
1952	1,315,087	1,266,542	48,545				1,091,257	1,076,719	20,538	223,536	195,531	28,005	294	292	2
1953	1,097,718	[4]	[4]				856,764	834,486	22,278	240,555	[4]	[3]	399	[3]	[3]
1954	1,017,685	946,151	71,534				788,113	764,492	23,921	226,432	180,084	46,348	2,840	1,575	1,265
1955	1,233,138	1,145,507	87,631	830,815	801,740	29,075	150,784	145,703	5,081	243,966	191,792	52,175	7,573	6,272	1,301
1956	1,373,996	1,289,108	84,888	922,585	888,653	33,932	194,530	190,758	3,772	249,849	202,776	47,073	7,032	6,921	111
1957	1,079,263	991,984	87,279	688,180	654,350	33,830	100,299	98,706	1,593	286,789	235,314	51,475	3,995	3,614	381
1958	939,437	861,396	78,041	635,697	607,073	28,624	21,025	18,606	2,419	280,550	234,559	45,991	2,165	1,158	1,007
1959	1,340,721	1,254,959	85,762	827,747	801,835	25,912	103,987	101,602	2,385	407,219	349,998	57,221	1,768	1,524	244
1960	1,364,543	1,282,068	82,475	959,823	909,314	50,509	72,646	66,560	6,086	329,263	303,530	25,733	2,811	2,664	147
1961	1,178,124	1,150,677	27,447	772,539	758,666	13,873	67,348	66,856	492	335,409	322,417	12,992	2,828	2,738	90
1962	1,360,067	1,290,474	69,593	848,975	834,080	14,895	94,027	93,281	746	413,035	359,083	53,952	4,030	4,030	---
1963	1,454,210	1,202,035	252,175	809,796	646,915	162,881	217,157	176,429	40,728	417,381	370,548	46,833	9,876	8,143	1,733
1964	1,640,098	1,418,382	221,716	990,488	876,810	113,678	148,577	111,419	37,158	486,181	417,357	68,824	14,852	12,796	2,056
1965	1,651,959	1,541,849	110,110	1,004,729	956,526	48,203	128,695	105,390	23,305	474,955	439,107	35,848	43,580	40,826	2,754
1966	1,497,741	1,428,060	69,681	934,490	892,660	41,830	125,578	117,211	8,367	384,731	367,713	17,018	52,942	50,476	2,466
1967	1,554,560	1,484,025	70,535	1,005,736	984,717	21,019	73,447	71,590	1,857	402,414	355,430	46,984	72,963	72,288	675
1968	1,630,052	1,572,839	57,213	1,029,594	1,027,443	2,151	130,711	130,317	394	390,086	335,558	54,528	79,661	79,521	140

[1] *Data for private ownership combined with State ownership for 1950-54*

[2] *Includes snags and down material existing prior to initial logging. Salvage of this material does not constitute drain on the volume of the forest inventory of live trees*

[3] *Data not available*

[4] *Incomplete data*

ACCURACY OF CURRENT INVENTORY DATA

Forest Land Area and Timber Volume

The estimates of forest land area and timber volume in the Puget Sound area were derived by sampling and consequently have sampling errors. Sampling errors have been computed for the estimates of commercial forest land area, noncommercial forest land area, net cubic-foot volume of growing stock, and net board-foot volume (International ¼-inch scale) of sawtimber. These sampling errors are presented in table 39 as a percent of the estimated total at the 68-percent and 95-percent probability levels. They may be interpreted as meaning that the odds are two out of three for 68-percent probability, or 19 out of 20 for 95-percent probability, that the ranges shown include the true value (i.e., the results of a 100-percent inventory). For example, we can expect, with 95-percent confidence, that the estimate of total commercial forest land area — 3,300,000 acres ± 2.3 percent (75,900 acres) — includes the true value.

In addition to measurable sampling errors, there may be other nonsampling errors due to mistakes in judgment, measurement, and compilation. The magnitude of errors from these sources cannot be determined. However, such errors are kept to a minimum through training, supervision, field checking, and complete editing and machine verification in compiling the data.

The sampling error of any breakdown of these totals will be substantially greater than for the total. The smaller the breakdown, the larger the sampling error. An approximation of the increasing sampling error can be obtained from table 40, which shows the sampling error associated with smaller estimates.

Table 39. — Sampling errors of estimates of forest area and timber volume, Puget Sound area, Washington, January 1, 1967

Item	Estimated total	Sampling error in percent	
		68-percent probability	95-percent probability
Commercial forest land	3,300,000 acres	±1.2	±2.3
Noncommercial forest land	1,563,000 acres[1]	±1.7	±3.3
Volume:			
Growing stock	14,715 million cubic feet	±1.5	±2.8
Sawtimber (International ¼-inch scale)	74,859 million board feet	±1.5	±2.8

[1] *Of the estimated 1,563,000 acres of noncommercial forest land in the Puget Sound area, 896,000 acres were classified by complete enumeration on maps and have no sampling error. The remaining 667,000 acres were classified by sampling procedures and have a sampling error of 4.1 percent at the 68-percent probability level and 7.8 percent at the 95-percent probability level.*

Table 40. — Approximate sampling error by size of estimate, Puget Sound area, Washington, January 1, 1967

Commercial forest land		Growing stock		Sawtimber	
Area	Sampling error[1]	Volume	Sampling error[1]	Volume	Sampling error[1]
Thousand acres	*Percent*	*Million cubic feet*	*Percent*	*Million board feet, International ¼-inch scale*	*Percent*
3,300	1.2	14,715	1.5	74,859	1.5
1,188	2.0	8,277	2.0	40,993	2.0
528	3.0	3,679	3.0	18,219	3.0
297	4.0	2,069	4.0	10,248	4.0
190	5.0	1,324	5.0	6,557	5.0
48	10.0	331	10.0	1,640	10.0
21	15.0	147	15.0	729	15.0
12	20.0	83	20.0	410	20.0
8	25.0	53	25.0	262	25.0
5	30.0	37	30.0	182	30.0
3	40.0	21	40.0	102	40.0
		13	50.0	66	50.0
		9	60.0	46	60.0
		7	70.0	33	70.0
		5	80.0	26	80.0
		4	90.0	20	90.0
		3	100.0	16	100.0

[1] *By random sampling formula; 68-percent probability.*

INVENTORY PROCEDURES

The summary tables in this report include data from the inventories of the Mount Baker and Snoqualmie National Forests, conducted by the Division of Timber Management, Region 6, U. S. Forest Service; and data from the inventory of lands outside the National Forests, conducted by the Forest Survey project, Pacific Northwest Forest and Range Experiment Station. National Forest lands were inventoried in 1964-66, lands outside the National Forests in 1966-67. No updating was done to bring data to a common date. The same general standards and definitions were used for both National Forests and lands outside the National Forests, except as explained in the following paragraphs.

National Forest Lands

Field plots were distributed on a systematic grid at 1.7-mile intervals on National Forest lands.

On the north half of the Mount Baker National Forest, field plots consisted of three 1/5-acre subplots located 6 chains apart. They were originally established in 1957. The current inventory data are based on the 1965 remeasurement of these plots. There were 891 subplots on the north half of the Mount Baker National Forest.

Field plots on the south half of the Mount Baker National Forest consisted of 10 sample points distributed systematically over an acre. The variable-radius plot sampling principle was used at each point to select the trees to be tallied. Where no trees were tallied, a ground cover class was recorded. Summations of the 10-point tally expressed the timber resources and conditions for that acre and were used to estimate forest area and volume. There were 223 10-point plots on the south half of the Mount Baker National Forest, established in 1966.

All field plots on the Snoqualmie National Forest consisted of three 1/5-acre subplots located 6 chains apart. Permanent 1/5-acre subplots were established on the Snoqualmie, Cedar River, Green River, and White River blocks of the Snoqualmie National Forest in 1957 but not on the Skykomish and Mineral blocks. The current inventory data are based on the 1964-65 remeasurement of the 1/5-acre subplots established in 1957 and on new 1/5-acre subplots established in 1964 and 1965. There were 822 subplots on that part of the Snoqualmie National Forest that lies within the Puget Sound area.

Growth estimates were based on data from the remeasurement of trees on the 1/5-acre subplots and from tree borings on newly established 10-point plots. Multiple regression equations were used to estimate tree diameter 1 year ago on the 10-point plots, and net volume was computed for both present and past diameters. Gross growth was obtained by subtracting past from present net volume.

Estimates of annual mortality were based on (1) the tally of dead trees previously recorded as live on the 1/5-acre subplots originally established in 1957 and (2) the tally of dead trees estimated to have died since 1961 on the newly established 10-point plots.

Lands Outside National Forests

A double sampling design was used for lands outside the National Forests. First, aerial photo sample plots were distributed systematically across the area. Photo plots were classified into one of three major land classes — commercial forest, noncommercial forest, and nonforest — and the commercial forest plots were further classified into stand volume classes. All photo plots were classified by kind of owner from public records. About 9,200 photo plots were examined. The second stage consisted of a basic

systematic grid of field plots 3.4 miles apart with supplemental plots added. A total of 787 field plots were established at photo plot locations. Plots consisted of 10 sample points distributed systematically over an acre. The same plot procedures used on the south half of the Mount Baker National Forest (see preceding section) were used on lands outside National Forests.

In addition to the two-stage sample using 10-point variable radius plots, previously established 1/5-acre plots were remeasured in all counties except Snohomish. The remeasured data were used to develop multiple regression equations of diameter growth, which in turn were used to estimate diameter 1 year ago for all trees on the 10-point variable radius inventory plots. Net volume was computed for both past and present diameters and gross growth was obtained by subtracting past from present net volume. Variables in the regression equations included d.b.h., average stand diameter, basal area per acre, tree age, crown ratio, site index, and combinations of these.

Annual mortality estimates are based on the tally of dead trees recorded as live on the originally established 1/5-acre plots in all counties except Snohomish, where mortality backdating methods were used. The mortality period is from 1957 to 1966 for Skagit and Whatcom Counties, 1959 to 1966 for King County and eastern Pierce County (in general the country east of Eatonville, Kapowsin, and Orting), and 1959 to 1967 for Island and Kitsap Counties and western Pierce County.

Timber Harvest

The timber harvest figures used in this report have been obtained from various reporting agencies using varying standards and methods of reporting. These timber cut figures are therefore not strictly comparable to Forest Survey's commercial forest land, volume, and growth data but are considered adequate for the analyses made.

DEFINITION OF TERMS

Land Area

Total Land Area

Includes dry land and land temporarily or partially covered by water, such as marshes, swamps, and river flood plains; streams, sloughs, and canals less than 1/8-mile wide; and lakes, reservoirs, and ponds less than 40 acres in area.

Forest Land Area

Land at least 16.7 percent stocked by trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Minimum area of forest land recognized is 1 acre.

Nonforest Land Area

Land that has never supported forests and lands formerly forested where use for timber management is precluded by development for other uses. Included are areas used for agricultural crops, improved pasture, residential areas, city parks, improved roads of any width and right-of-way clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and other nonforest strips must be more than 120 feet wide, and clearings, etc., more than 1 acre in size, to qualify as nonforest land.

Forest Land Classes

Commercial Forest Land Area

Forest land which is producing or capable of producing industrial wood and not withdrawn from timber utilization.

Noncommercial Forest Land Area

Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions, and productive public forest land withdrawn from commercial timber use through statute or administrative regulation.

Productive-reserved. — Public forest land withdrawn from timber utilization through statute, ordinance, or administrative order, but which otherwise qualifies as commercial forest land. Also included are forest lands managed exclusively for Christmas tree production.

Unproductive. — Forest land incapable of yielding crops of industrial wood products because of adverse site conditions such as sterile soil, poor drainage, high elevation, steepness, and rockiness.

Forest Types

Forest types are determined on the basis of species plurality of all live trees that contribute to stocking, considering both size and spacing.

Tree Classes

Growing-stock Trees

Sawtimber trees, poletimber trees, saplings, and seedlings; that is, all live trees except cull trees.

Acceptable trees. — Growing-stock trees of commercial species meeting specified standards of size and quality but not qualifying as desirable trees.

Desirable trees. — Growing-stock trees of commercial species (1) having no serious defects in quality limiting present or prospective use for timber products, (2) of relatively high vigor, and (3) containing no pathogens that may result in death or serious deterioration before rotation age.

Sawtimber trees (11.0-inch d.b.h. and larger). — Live trees of commercial species. Softwood trees must contain at least one 12-foot saw log with a top diameter not less than 6 inches inside bark; hardwood trees must contain at least one 8-foot saw log with a top diameter not less than 8 inches inside bark. At least 25 percent of the board-foot volume in a tree must be free of defect for either softwoods or hardwoods.

Poletimber trees (5.0- to 10.9-inch d.b.h.). — Live trees of commercial species not less than 50 percent sound on a cubic-foot basis and with no disease, defects, or deformities which are likely to prevent their becoming growing-stock sawtimber trees.

Sapling and seedling trees (less than 5.0-inch d.b.h.). — Live trees of commercial species with no disease, defects, or deformities which are likely to prevent their becoming growing-stock poletimber trees.

Nongrowing-stock Trees

Cull trees. — Trees of noncommercial species and trees of commercial species which are too defective or which are unlikely to become growing-stock trees due to deformity, disease, low vigor, etc.

Sound cull trees: Trees of noncommercial species or with excessive defect due to form, roughness, etc.

Rotten cull trees: Trees with excessive defect due primarily to rot.

Mortality trees. — Trees of commercial species which have died from natural causes within a specified period and which were not cull trees at the time of death.

Salvable dead trees. — Standing or down dead trees of commercial species 11.0 inches or more in diameter that contain 25 percent or more of sound volume and at least one merchantable 16-foot log if a softwood or one merchantable 8-foot log if a hardwood.

Stand-size Classes

Sawtimber Stand

Stand at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber and poletimber trees, and with sawtimber stocking equal to or greater than poletimber stocking.

Large sawtimber stand. — Stand in which the majority of the sawtimber stocking is in trees 21.0-inch d.b.h. and larger.

Small sawtimber stand. — Stand in which the majority of the sawtimber stocking is in trees from 11.0- to 20.9-inch d.b.h.

Poletimber Stand

Stand at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber and poletimber trees, and with poletimber stocking exceeding sawtimber stocking.

Sapling and Seedling Stand

Stand at least 16.7 percent stocked with growing-stock trees, with more than half of this stocking in saplings and/or seedlings.

Nonstocked Area

An area of commercial forest land less than 16.7 percent stocked with growing-stock trees.

Stocking

Stocking is an expression of the extent to which growing space is effectively utilized by present or potential growing-stock trees of commercial species. "Percent of stocking" is synonymous with "percentage of growing space occupied" and means the ratio of actual stocking to full stocking for comparable sites and stands. Basal area is used as a basis for measuring stocking.

Age

Stand Age

Stand age is based upon growing-stock stocking. In order for a stand to be even-aged, a majority of the growing-stock stocking must be in two adjacent age classes. Stands that do not meet this criterion are classified as uneven-aged, under or over rotation age.

Rotation Age

The period of years between establishment of a stand of timber and the time when it is considered ready for cutting. Rotation age in softwood stands is 100 years; in hardwood stands, it is 50 years.

Old-growth Sawtimber Stand

Sawtimber stand in which 50 percent or more of the growing stock is in trees at least 140 years old.

Young-growth Sawtimber Stand

Sawtimber stand in which more than 50 percent of the growing stock is in trees less than 140 years old.

Timber Volume

Live Sawtimber Volume

Net volume in board feet of live sawtimber trees of commercial species. Net volume equals gross volume less deduction for rot, sweep, crook, and other defects that affect use for lumber.

Scribner rule. — The common board-foot log rule used in determining volume of sawtimber in Washington. Scribner volume in the Puget Sound area is measured in terms of 32-foot logs.

International ¼-inch rule. — The standard board-foot log rule adopted nationally by the Forest Service for the presentation of Forest Survey volume statistics.

Saw-log portion. — That part of the bole of sawtimber trees between the stump and the saw-log top.

Upper-stem portion. — That part of the bole of sawtimber trees above the saw-log top to a minimum top diameter of 40 inches outside bark or to the point where the central stem breaks into limbs.

Growing-stock Volume

Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4.0-inch top (of central stem) outside bark. Net volume equals gross volume less deduction for rot and missing bole sections.

All Timber Volume

Net volume in cubic feet of live and salvable dead sawtimber trees and poletimber trees of commercial species, and cull trees of all species from stump to a minimum 4.0-inch top outside bark.

Industrial Wood

All roundwood products, except fuelwood.

Net Annual Growth

The increase in net volume of a specified size class for a specific year. (Components of net annual growth include the increment in net volume of trees at the beginning of the specific year surviving to the year's end plus net volume of trees reaching the size class during the year minus the net volume of trees that died during the year minus the net volume of trees that became culls during the year.)

Ownership Classes

National Forest Lands

Federal lands which have been designated by Executive order or statute as National Forest or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones title III lands.

Other Public Lands

Federal lands other than National Forests, including lands administered by the Bureau of Land Management, Bureau of Indian Affairs, and miscellaneous Federal agencies, and lands owned by States, counties, and local public agencies, or lands leased by these governmental units for more than 50 years.

Forest Industry Lands

Lands owned by companies or individuals operating wood-using plants.

Farmer-owned Lands

Lands owned by operators of farms.

Miscellaneous Private — Corporate Lands

Lands owned by companies or corporations that do not operate wood-using plants. Included are corporate farms, some railroad lands, oil company lands, real estate and landholding company lands, and lands held by banks and other financial institutions and various other companies and corporations.

Miscellaneous Private — Noncorporate Lands

Privately owned lands other than forest industry, farmer-owned, or corporate lands. Included are lands owned by professionals such as doctors, college professors, industrial engineers, and business managers; permanent and summer homesite lands outside city limits; and other lands held by private individuals.

Normal Yield Table

A normal yield table is a tabulation of the volume, basal area, number of trees, etc., per acre found in fully stocked stands on specified sites at specified ages.

TREE SPECIES

Principal tree species found on the commercial forest land in the Puget Sound area include:

Softwoods:
Alaska-cedar *(Chamaecyparis nootkatensis)*
Douglas-fir *(Pseudotsuga menziesii)*
Engelmann spruce *(Picea engelmannii)*
Grand fir *(Abies grandis)*
Lodgepole pine *(Pinus contorta)*
Mountain hemlock *(Tsuga mertensiana)*
Noble fir *(Abies procera)*
Pacific silver fir *(Abies amabilis)*
Pacific yew *(Taxus brevifolia)*[1]
Ponderosa pine *(Pinus ponderosa)*[2]
Sitka spruce *(Picea sitchensis)*
Subalpine fir *(Abies lasiocarpa)*
Western hemlock *(Tsuga heterophylla)*
Western redcedar *(Thuja plicata)*
Western white pine *(Pinus monticola)*
Whitebark pine *(Pinus albicaulis)*[3]

Hardwoods[4]**:**
Bigleaf maple *(Acer macrophyllum)*
Black cottonwood *(Populus trichocarpa)*
Cherry *(Prunus* spp.*)*[1]
Crab apple *(Malus* spp.*)*[1]
Hawthorn *(Crataegus* spp.*)*[1]
Oregon ash *(Fraxinus latifolia)*
Oregon white oak *(Quercus garryana)*
Pacific dogwood *(Cornus nuttallii)*[1]
Pacific madrone *(Arbutus menziesii)*
Red alder *(Alnus rubra)*
Western paper birch *(Betula papyrifera* var. *commutata)*
Willow *(Salix* spp.*)*

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[1] *Noncommercial species.*
[2] *Extremely limited in the Puget Sound area. Found in a few natural stands on the Fort Lewis Plains and in a few plantations.*
[3] *Found only in high mountains near timberline, generally on noncommercial forest land.*
[4] *In the Puget Sound area, a number of "brush" species occasionally attain tree size. They were not tallied as trees on this survey. Included are:*
Cascara buckthorn (Rhamnus purshiana)
Elderberry (Sambucus *spp.*)
Indian plum (Osmaronia cerasiformus)
Ocean spray (Holodiscus discolor)
Rhododendron (Rhododendron *spp.*)
Serviceberry (Amelanchier *spp.*)
Sitka alder (Alnus sinuata)
Vine maple (Acer circinatum)

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Research Paper:

PNW-84	Projected Developments of the Timber Economy of the Columbia-North Pacific Region	1969

Available from: Pacific Northwest Forest & Range Experiment Station
Post Office Box 3141
Portland, Oregon 97208

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AFLC/HAFB/OGDEN

USDA Forest Service
Resource Bulletin PNW-37

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1970 WASHINGTON TIMBER HARVEST

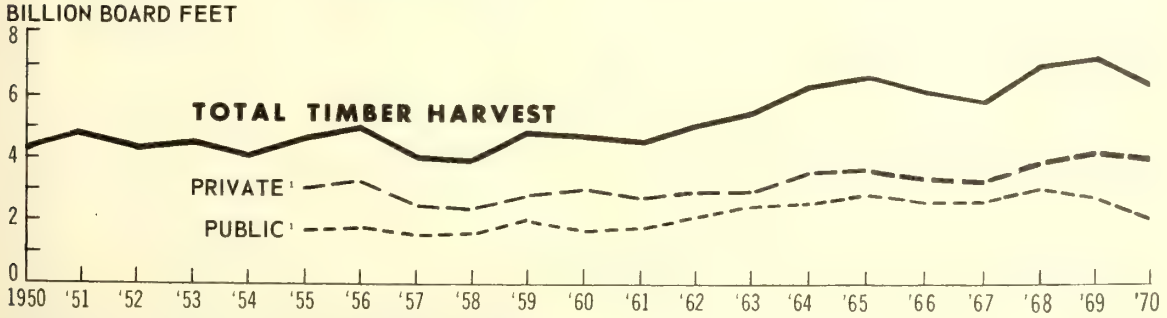
by
Brian R. Wall, *Associate Economist*

Washington's 1970 timber harvest of 6.46 billion board feet was 7.8 percent below the near record harvest of 7 billion board feet established in 1969. Timber harvests on all public lands declined 13 percent with a 9.0-percent reduction in western Washington and a 22.9-percent drop in eastern Washington. State lands led the decline in public production with a 142-million-board-foot drop from 1969 (down 19.1 percent) followed by the National Forests with a 140.8-million-board-foot drop (down 9.3 percent). Production on Indian lands declined 52.6 million board feet (down 12.5 percent) during 1970. Log production by other non-Federal and other Federal agencies declined 13 billion board feet and 11.9 billion board feet, respectively. The Bureau of Land Management's 1970 harvest rose 1.2 million board feet above that recorded in 1969.

The total private timber harvest declined 184.8 million board feet, although industrial timberland owners had a slight increase in production between 1969 and 1970. The "other private" (nonindustrial) timberland owners accounted for this decline with a 22.6-percent drop in production. Private timber harvest declined 4.8 percent in western Washington but rose 1.4 percent in eastern Washington due to increases in nonindustrial private production.

During 1970 National Forest stumpage prices declined through the first half of the year, recovered somewhat in the third quarter, and then declined in the fourth quarter. The average public stumpage price for 1970 was below the 1969 average by 41.5 percent in western Washington and by 54.7 percent in eastern Washington. The volume of public timber sold dropped 21 percent, and the volume of uncut public timber under contract rose 32.6 percent to 6.6 billion board feet by yearend 1970.

WASHINGTON TIMBER HARVEST 1950–70



¹Separate data for public and private not available prior to 1955.

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION

Philip A. Briegleb, Director
FOREST SERVICE

Portland, Oregon
U.S. Department of Agriculture

Timber Harvest by Ownership in State of Washington, 1970 [1/]

(In thousands of board feet, Scribner log scale)

Unit-State and county	Private [2/]						State [2/]		Bureau of Land Management [4/]		National Forests [4/]		Indian lands [4/]		Other public [2/]		Other Federal [2/5/]		Total production
	Industrial		Other		Total private														
	Live	Dead [3/]	Live	Dead [3/]	Live	Dead [3/]	Live	Dead [3/]	Live	Dead [3/]	Live	Dead [3/]	Live	Dead [3/]	Live	Dead [3/]	Live	Dead [3/]	
Western Washington																			
Clallam	154,410	85	34,022	145	188,432	230	92,098	744	--	--	53,974	1,134	18,549	5	65	--	--	--	355,231
Clark	10,464	--	5,041	--	15,505	--	7,144	560	--	--	--	--	--	--	--	--	100	--	23,309
Cowlitz	521,773	--	34,519	20	556,292	20	63,389	58	--	--	8,039	86	--	--	1,110	--	--	--	628,994
Grays Harbor	244,816	4	98,898	443	343,714	447	8,125	39	--	--	58,707	6,812	139,322	31	12,725	4	--	--	569,926
Island	6,465	--	8,294	--	14,759	--	914	--	--	--	--	--	--	--	23	--	--	--	15,696
Jefferson	101,966	613	43,245	3,016	145,211	3,629	186,174	4,877	--	--	29,315	5,418	--	--	145	--	222	--	374,991
King	302,083	--	72,588	--	374,671	--	9,395	--	--	--	61,833	1,767	61	--	13,880	--	--	--	461,607
Kitsap	4,815	136	21,128	--	25,943	136	1,939	7	--	--	--	--	--	--	296	--	772	--	29,093
Lewis	505,901	16	43,739	170	549,640	186	19,777	--	--	--	165,068	5,298	--	--	64	--	--	--	740,033
Mason	41,629	--	25,592	--	67,221	--	7,070	--	--	--	97,182	1,405	--	--	--	--	1,000	--	173,878
Pacific	572,552	25	8,436	255	580,988	280	13,923	222	--	--	--	--	--	--	--	--	--	--	595,413
Pierce	262,971	--	29,623	--	292,594	--	16,574	7	--	--	41,018	21,714	--	--	404	--	10,172	--	382,483
San Juan	1,400	--	386	--	1,786	--	--	--	--	--	--	--	--	--	--	--	--	--	1,786
Skagit	170,136	160	10,053	25	180,189	185	24,205	25	--	--	79,048	4,755	--	--	60	--	--	--	288,467
Skamania	26,221	215	57,500	--	83,721	215	16,709	93	--	--	266,394	31,474	--	--	10	--	--	--	398,616
Snohomish	85,294	--	29,127	10	114,421	10	36,524	--	--	--	77,747	10,727	--	--	100	--	18	--	239,547
Thurston	47,128	--	23,329	429	70,457	429	5,870	--	--	--	--	--	--	--	--	--	7,251	--	84,007
Wahkiakum	78,977	50	4,800	--	83,777	50	15,988	3	--	--	--	--	--	--	3,357	--	--	--	103,175
Whatcom	60,719	--	8,741	--	69,460	--	16,794	--	--	--	13,812	2,679	--	--	190	--	--	--	102,935
Total	3,199,720	1,304	559,061	4,513	3,758,781	5,817	542,612	6,635	--	--	952,137	93,269	157,932	36	32,429	4	19,535	--	5,569,187
Total live and dead	3,201,024		563,574		3,764,598		549,247		--		1,045,406		157,968		32,433		19,535		5,569,187
Eastern Washington																			
Adams	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Asotin	--	--	7,029	--	7,029	--	--	--	--	--	1,869	49	--	--	--	--	--	--	8,947
Benton	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chelan	10,723	--	1,681	--	12,404	--	908	--	--	--	46,685	872	--	--	337	--	--	--	61,206
Columbia	--	--	2,650	--	2,650	--	--	--	--	--	8,733	66	--	--	--	--	--	--	11,449
Douglas	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ferry	17,883	--	6,377	--	24,260	--	1,635	--	--	--	43,643	1,476	63,888	--	--	--	--	--	134,902
Franklin	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Garfield	--	--	920	--	920	--	--	--	--	--	14,828	137	--	--	--	--	--	--	15,885
Grant	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kittitas	18,338	332	30,144	64	48,482	396	3,239	--	--	--	28,638	1,139	--	--	--	--	--	--	81,894
Klickitat	53,214	--	6,139	100	59,353	100	7,558	1,340	--	--	3,151	43	559	30	--	--	--	--	72,134
Lincoln	--	--	712	--	712	--	61	--	--	--	--	--	--	--	--	--	--	--	773
Okanogan	4,377	--	5,709	--	10,086	--	21,751	20	5	--	45,790	1,684	23,952	--	--	--	--	--	103,288
Pend Oreille	2,955	--	8,091	70	11,046	70	323	--	--	--	62,201	293	309	--	--	--	--	--	74,242
Spokane	1,380	--	16,753	136	18,133	136	--	20	--	--	--	--	--	--	300	--	250	--	18,839
Stevens	30,896	--	26,410	--	57,306	--	2,775	24	3,415	--	15,488	83	5,519	--	120	--	2,533	--	87,263
Walla Walla	485	--	3,752	--	4,237	--	--	--	--	--	--	--	--	--	--	--	--	--	4,237
Whitman	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	1
Yakima	6,294	--	17,254	--	23,548	--	13,166	--	--	--	55,349	646	112,876	2,806	7,233	--	--	--	215,624
Total	146,545	332	133,621	370	280,166	702	51,416	1,404	3,421	--	326,375	6,488	207,103	2,836	7,990	--	2,783	--	890,684
Total live and dead	146,877		133,991		280,868		52,820		3,421		332,863		209,939		7,990		2,783		890,684
Total Washington	3,346,265	1,636	692,682	4,883	4,038,947	6,519	594,028	8,039	3,421	--	1,278,512	99,757	365,035	2,872	40,419	4	22,318	--	
Total live and dead	3,347,901		697,565		4,045,466		602,067		3,421		1,378,269		367,907		40,423		22,318		6,459,871

1/ Includes volume in logs, poles, piling, shingle bolts, etc.

2/ Compiled by the Washington State Department of Natural Resources.

3/ Includes snags and down material existing prior to initial logging.

4/ Compiled by respective agencies, U.S. Bureau of Land Management, U.S. Forest Service, U.S. Bureau of Indian Affairs.

5/ Includes lands logged under jurisdiction of U.S. Department of the Interior--Bonneville Power Administration, National Park Service, and Bureau of Sport Fisheries and Wildlife; and U.S. Department of the Army.

Prepared by Forest Survey Project, Pacific Northwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, Portland, Oregon.

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FLOWS OF MILL RESIDUES TO PULP AND BOARD MANUFACTURERS, WASHINGTON, OREGON, AND CALIFORNIA, 1968

GROVER A. CHOATE

LEWISTON ... OCT 24 ...

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
FOREST SERVICE • U.S. DEPARTMENT OF AGRICULTURE
PORTLAND, OREGON

USDA FOREST SERVICE
RESOURCE BULLETIN PNW-39
1972

ABSTRACT

Twelve million tons of residues from lumber and veneer and plywood mills went to pulp and board use in 1968; nearly 88 percent went to domestic mills and most of the remainder to overseas export. Of the 10.3 million tons that went to domestic mills, 83 percent went to pulpmills (average distance 82 miles) and 17 percent to board mills (30 miles); 74 percent was shipped by lumber mills (68 miles) and 26 percent by veneer and plywood mills (88 miles). Fifty percent of residues to domestic mills went by truck (37 miles), 35 percent by rail (147 miles), 6 percent by barge (59 miles), and 9 percent by onsite transport (1 mile). One-fourth of the shipments to domestic mills were between mills of the same ownership and three-fourths between mills of different ownerships. Percentage of sawmill residues going by truck decreased with increasing sawmill size; rail, onsite, and barge use increased. Nine million tons of wood residues of sawmills and veneer and plywood mills were either unused or went for fuel in 1968. Residue volumes, shipping distances, etc., varied among the eight pulp and board manufacturing areas used in the report.

Keywords: Freight transportation, pulpmills, sawmills, manufacturing.

FOREWORD

This report presents statistics on shipments of residues during 1968 from sawmills and veneer and plywood mills in Washington, Oregon, and California to pulp and board mills within this three-State area. Information also is shown on shipments of chips from sawmills and veneer and plywood mills directly to export. Not included, however, are data on export shipments from pulp and board mills either to export or to other pulp and board mills, or on import shipments from neighboring States (Idaho and Montana) or British Columbia. Because of these limitations of the data, as well as for other reasons, statistics in this report cannot be used to estimate 1968 consumption of residues by pulp and board mills or the actual volume of exports. The statistics shown here are intended only to bring out intrinsic features of shipments--amount and average distance by various types of carriers (truck, rail, etc.), areas of origin and destination, and types of shipping and receiving mills.

Information in a recent report on cost of residue shipment in Oregon in relation to such factors as distance, type of carrier, and type of residue should provide a basis for further economic analysis of residue movements on the west coast. The report appears in Volume 21, Number 10, of the *Forest Products Journal*--"Transportation Costs in Oregon for Wood and Bark Residues" by Paul E. Hyde and Stanley E. Corder.

The statistics shown in this report result from surveys conducted in 1969 by the Forest Survey staff of the Pacific Northwest Forest and Range Experiment Station in cooperation with the State of Washington Department of Natural Resources, the State of Oregon Department of Forestry, and the State of California Division of Forestry. Members of these agencies visited practically all primary wood processing mills in the three States to collect survey information. Personal visits were made at most mills; contacts by phone were necessary in a few cases. Reports which have been published as a result of these surveys (and as referenced in the body of this report) do not include most of the statistics shown here on residue shipments. On the other hand, certain data from these published reports are repeated here to provide pertinent background information.

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HIGHLIGHTS

- In 1968, 56 percent of the 728 west coast sawmills and 88 percent of the 180 veneer manufacturing mills produced residues for domestic or foreign manufacture of pulp and board.

- Of the 12 million tons of residues generated by lumber and veneer and plywood mills in 1968, nearly 88 percent went to west coast pulp and board mills and most of the remainder to overseas export facilities.

- Of the 10.3 million tons of residues going to west coast pulp and board mills, 82 percent were intrastate shipments.

- Of the shipments to west coast pulp and board mills, 83 percent went to pulpmills (average distance 82 miles) and 17 percent to board mills (30 miles).

- Of shipments to pulp and board mills, 74 percent came from lumber mills (68 miles), and 26 percent from veneer and plywood mills (88 miles).

- Of the residues shipped to west coast pulp and board mills, 50 percent went by truck (average distance 37 miles), 35 percent by rail (147 miles), 6 percent by barge (59 miles), and 9 percent by onsite transportation (1 mile).

- Of the shipments from sawmills and veneer and plywood mills to west coast pulp and board mills, 25 percent were between mills of the same ownership (average distance 50 miles) and 75 percent between mills of different ownership (82 miles).

- The percentage of sawmill residues going by truck decreased with increasing sawmill size, while rail, onsite, and barge use increased.

- More than 9 million tons of wood residues of sawmills and veneer and plywood mills were either unused or went for fuelwood.

BACKGROUND

A need for more information on residues from the manufacture of lumber and veneer as a source of raw material for pulp and board[1] plants stems from the vastly increased use of such material during the last couple of decades and prospects for still greater use. In 1952, only 14 percent of the slabs, edgings, shavings, sawdust, veneer clippings, and similar material from the wood content of logs processed by lumber, veneer, and plywood mills on the west coast[2] was used as a source of fiber for pulp and board manufacture. By 1968, 71 percent of the wood residues went for such use. Pulp and board mills have come to rely largely on chips and other residues for their wood supply; in 1968, residues accounted for 82 percent of the pulpwood consumption of west coast mills--68 percent in Washington, 95 percent in Oregon, and 99 percent in California.

The rapid increase in foreign markets for pulpwood chips is another very significant development during recent years. The 2.1 million tons of chips exported from west coast ports in 1970 undoubtedly came mainly from mill residues and represented a continuation of the annual increases that have occurred since 1965 (the first year for which there were significant exports).[3]

Although several publications[4] describe the patterns of roundwood flows to pulp and board mills in west coast States, relatively little is known about movements of residues between individual types of residue-producing and-consuming mills. However, with the volume of residues going into pulp and board use reaching a total of 12 million tons (in 1968) and becoming by far the principal source of wood supply, there are mounting demands for more information useful to people concerned with transportation and present and potential markets for residue. Although individual mills and corporations are very familiar with the economic aspects of their respective marketing (or purchasing) situations for chips and other pulping residues, practically nothing has been published showing the composite situation for large areas

[1] Board mills consist of those producing hardboard, particle board, and insulation board.

[2] "West coast" in this report refers to the area made up of Washington, Oregon, and California.

[3] David R. Darr. Production, prices, employment, and trade in Northwest forest industries, fourth quarter 1970. Pac. Northwest Forest & Range Exp. Stn., USDA Forest Serv., 57 p., illus., 1971.

[4] John W. Austin. Timber flows and utilization patterns in the Douglas-fir region, 1966. Pac. Northwest Forest & Range Exp. Stn., USDA Forest Serv. Res. Pap. PNW-89, 89 p., illus., 1969.

John A. Bergvall and Donald R. Gedney. Washington mill survey: Wood consumption and mill characteristics, 1968. A joint study by State of Wash., Dep. Natur. Resour., and Pac. Northwest Forest & Range Exp. Stn., USDA Forest Serv., 119 p., illus., 1970.

Eugene R. Manock, Grover A. Choate, and Donald R. Gedney. Oregon timber industries: Wood consumption and mill characteristics, 1968. A joint study by State of Oreg., Dep. For., and Pac. Northwest Forest & Range Exp. Stn., USDA Forest Serv., 122 p., illus., 1970.

Brian R. Barrette, Donald R. Gedney, and Daniel D. Oswald. California timber industries, 1968: Mill characteristics and wood supply. A joint study by the Calif. Div. For., and the Pac. Northwest Forest & Range Exp. Stn., USDA Forest Serv., 117 p., illus., 1970.

such as the west coast States. What, for example, are distances that mills of various types ship pulping residues? What is the relationship between distance and type of carrier (truck, rail, etc.)? How do these relationships vary from one part of the west coast to another? Data for 1968, shown in the tables and discussed briefly in the text, furnish many of these types of information. However, it is not an objective of this report to interpret the data and reach economic conclusions. Such uses of the data are far too numerous and varied and are left to those concerned with making detailed studies.

Eight geographic areas used to describe west coast residue production and use

In 1968, west coast residues destined for pulp and board use were transported from 570 lumber and veneer and plywood mills to 86 pulp and board mills[5/] as well as to several export locations. The pattern of flow of residues is described in this report in terms of eight pulp and board manufacturing areas. These areas, along with the location of pulp and board mills, are shown in figure 1. In delineating areas (along county and, in some places, State lines) the objective was to group pulp and board manufacturing facilities in geographic areas small enough to make data on residue movement sensitive without disclosure of data for individual mills. These areas approximate both Forest Survey reporting areas and in some instances State-delineated economic planning areas.

Areas vary substantially with respect to number of mills of various type (tables 1 and 2) and their installed capacity (tables 3 and 4). The Lower Columbia and Interior California Areas lead with respect to installed capacity of sawmills. The West Central and Southwest Oregon Areas have the biggest veneer and plywood industry and also lead in board manufacturing facilities. The Northwest Washington and Lower Columbia Areas have by far the greatest concentration of pulpmills and pulp-making capacity.

A number of other factors, external to the physical characteristics of mills, also influence use and movement of residues. Size of area is, of course, a primary consideration. Another is the volume of available timber and the characteristics of the trees--size, species, quality, etc. In the large Eastern Oregon Area, for example, fuller utilization of residues is discouraged by the relatively great distance to markets from the widely dispersed residue-producing mills. Markets and transportation facilities also have very important effects on the amount of industrial development; the Lower Columbia Area, for example, is well favored with rail, truck, water, and port facilities for distributing timber to numerous domestic and overseas markets.

Fifty-six percent of the west coast sawmills and 88 percent of the veneer and plywood mills reported production of residues for pulp and board manufacturing in 1968. Percentages varied considerably among areas, particularly in the case of sawmills as shown below:

Area	Sawmills	Veneer and plywood mills
Northwest Washington	44	60
Lower Columbia	58	94
West Central Oregon	78	85
Southwest Oregon	75	98
Coastal California	59	94
Eastern Washington	45	75
Eastern Oregon	52	89
Interior California	45	100
Average	56	88

[5] Not included are one pulpmill that reported no use of residues and three mills that manufactured roofing felt.

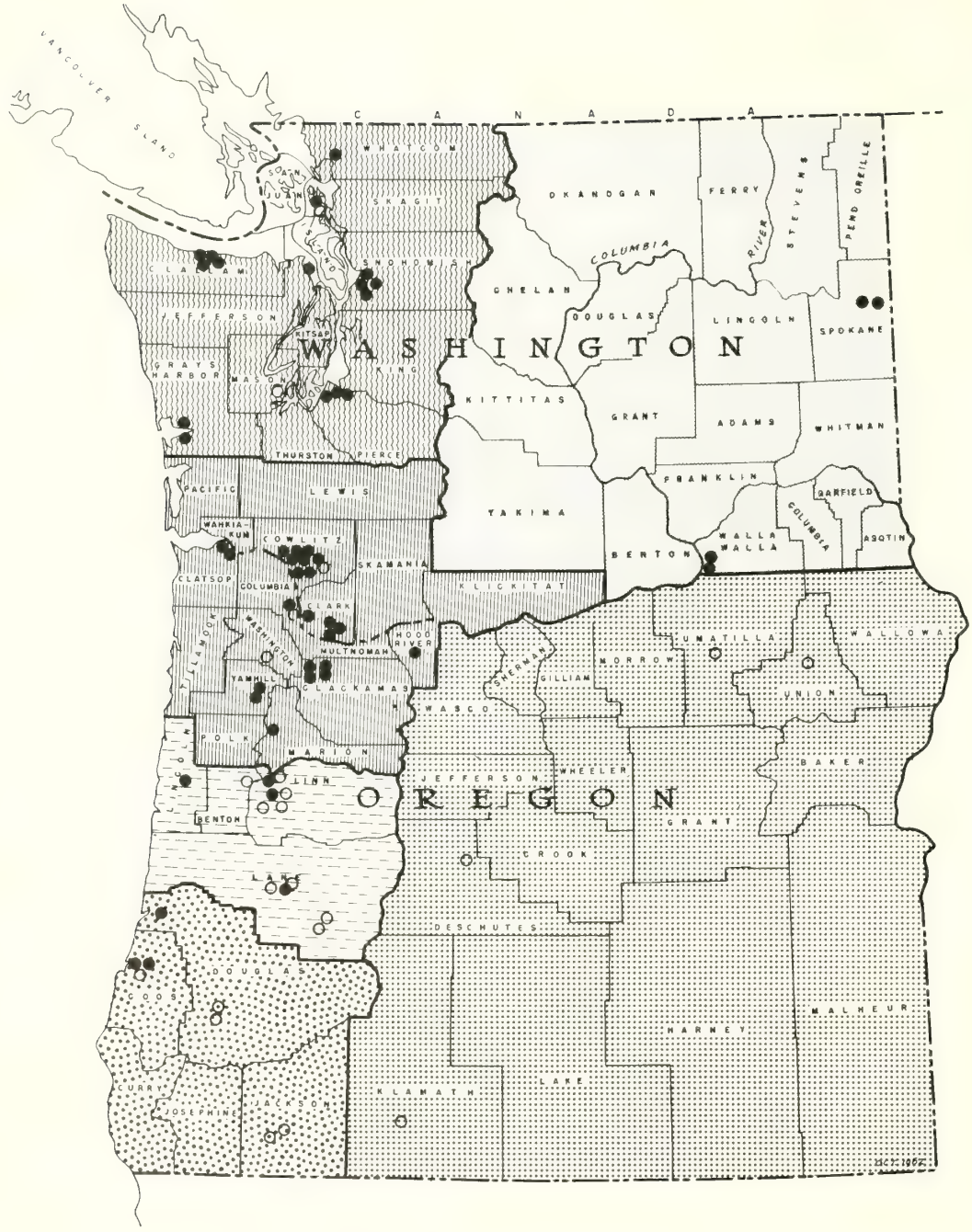
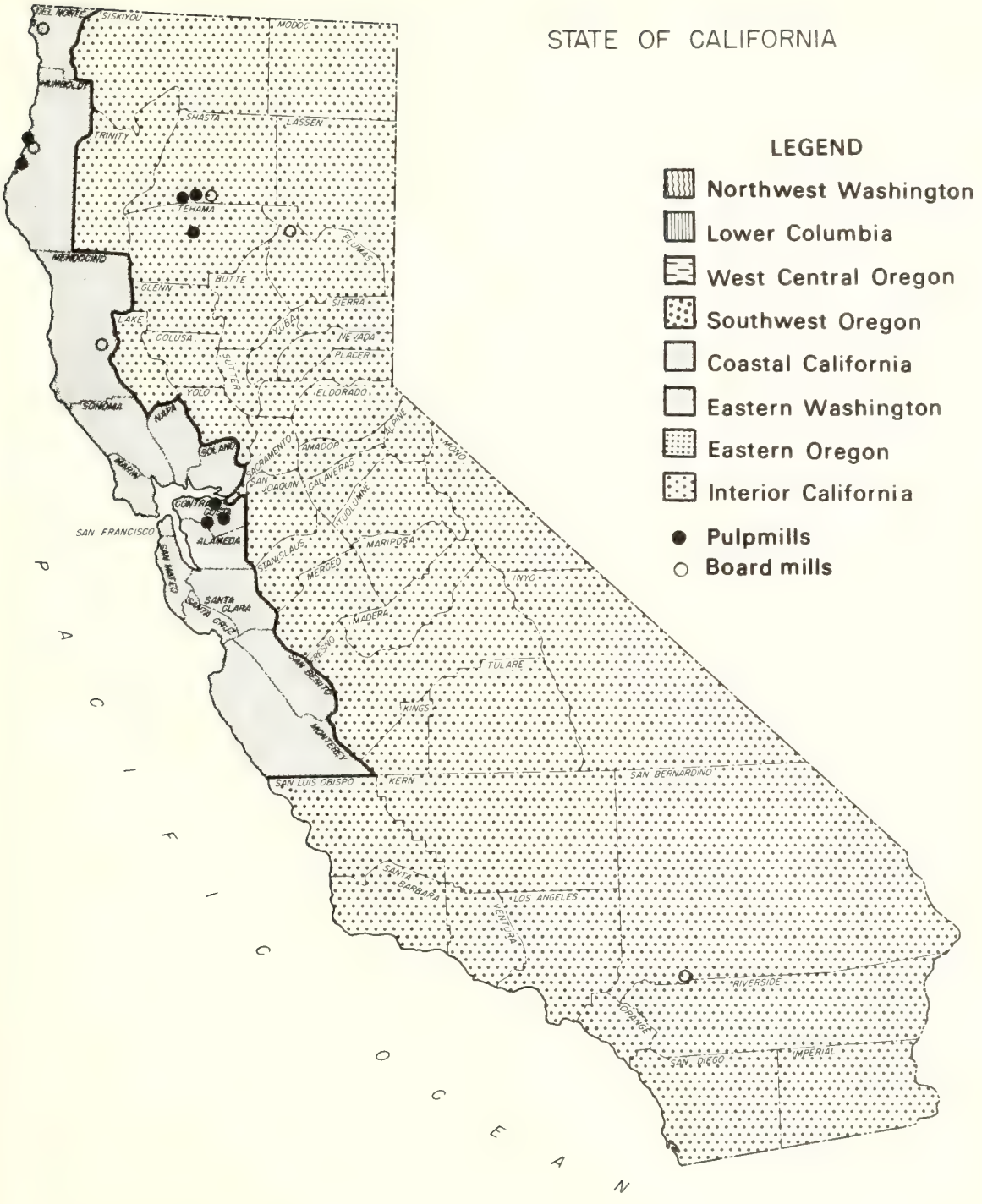


Figure 1.—Pulp and board manufacturing areas and mill locations, 1968.


STATE OF CALIFORNIA
LEGEND
Northwest Washington
Lower Columbia
West Central Oregon
Southwest Oregon
Coastal California
Eastern Washington
Eastern Oregon
Interior California
Pulpmills
Board mills
DEL NORTE
SISKIYOU
MODOC
HUMBOLDT
SHASTA
LASSEN
TRINITY
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
LAKE
COLUSA
YUBA
NEVADA
PLACER
SUTTER
YOLO
EL DORADO
SONOMA
NAPA
ALPINE
MONO
SOLANO
SACRAMENTO
AMADOR
MARIN
SAN JOAQUIN
CALAVERAS
TUOLUMNE
CONTRA COSTA
ALAMEDA
SAN FRANCISCO
STANISLAUS
MARIPOSA
MERCED
INYO
SAN MATEO
SANTA CLARA
SANTA CRUZ
MADERA
FRESNO
TULARE
SAN BENITO
KINGS
MONTEREY
KERN
SAN LUIS OBISPO
SAN BERNARDINO
SANTA BARBARA
LOS ANGELES
VENTURA
RIVERSIDE
ORANGE
SAN DIEGO
IMPERIAL
PACIFIC OCEAN

Similar comparisons by States show that 68 percent of the sawmills in Oregon produced residues for pulp and board use, but only 46 percent in Washington and 51 percent in California. For veneer and plywood mills, percentages were 96 in California, 91 in Oregon, and 76 in Washington.

An underlying factor related to the relatively high percentages shown above for sawmills in the West Central Oregon and Southwest Oregon Areas is the high percentage of large mills, which are far more likely to produce residues for pulp and board use than are small mills:

Sawmill-size class (Board-foot capacity per 8 hours)	Percentage
120,000 plus	96
80,000-119,000	84
40,000-79,000	66
Less than 40,000	19
Average	56

The fact that a great many large mills come under the same ownership as pulp and board mills (and are commonly located nearby) enhances their market opportunities for residues. Smaller mills, on the other hand, are less likely to be corporately owned with few situated as part of an integrated operation, and their relatively low volume of residue production makes utilization of residue more costly.

DISTRIBUTION PATTERNS

Shipments mainly to domestic pulp and board plants

Nearly 12 million tons of chips and other wood residues (mainly sawdust and shavings) were shipped from lumber, veneer, and plywood mills to pulp and board mills, export facilities,[6] and other mills[7] (table 5).

Destination	Million tons	Percent
Pulp and board mills	10.26	88
Export	1.42	12
Other mills	.01	(8)
Total	11.69	100

[6] Export shipments shown in this report consist only of those going directly from lumber and veneer and plywood mills to export facilities; they do not include reshipments to export from pulp and board mills.

[7] "Other mills" are those which manufactured roofing felt.

[8] Less than 0.5 percent.

Of the 11.7 million tons that went to domestic and export use, 8.6 million tons came from lumber mills and 3.1 million from veneer and plywood mills.

Although details of export shipments are of subordinate concern in this report, they will be summarized briefly before getting into the major topic of shipments to domestic mills.

Of the 1.42 million tons of residues reported as shipped for export, 0.98 million tons was produced by lumber mills (69 percent) and 0.44 million tons by veneer and plywood mills (31 percent). Most of this volume was produced in Southwest Oregon:

Area	Export volume
	(Percent)
Northwest Washington	3
Lower Columbia	7
West Central Oregon	6
Southwest Oregon	75
Coastal California	1
Eastern Washington	--
Eastern Oregon	--
Interior California	8
Total	100

The average hauling distance of export shipments[9] was 54 miles--considerably less than the 73 miles to pulp and and board mills. This relatively short haul resulted mainly from the high percentage of export shipments that moved to ports by onsite transport[10]--25 percent as compared with only 9 percent for material moving to pulp and board mills. Railroads carried only a very small amount to export facilities but accounted for 35 percent of shipments to pulp and board mills. The onsite shipments were largely at Coos Bay in the Southwest Oregon Area.

Oregon the leading State in shipments to pulp and board mills

Of the 10.3 million tons of residue material that moved to west coast pulp and board plants, nearly three-fifths came from mills in Oregon; California and Washington each accounted for about one-fifth (table 6). More than four-fifths of the shipments did not cross State lines. As shown in figure 2, the principal interstate shipments were from Oregon to Washington; these were largely to mills at Longview and Camas within the Lower Columbia Area.

Lower Columbia Area led in shipments to and receipts by pulp and board mills

Pulp and board mills in the Lower Columbia Area provided a major market for residues. These mills with 30 percent of the installed capacity on the west coast attracted 24 percent of the residues (table 7). Other leading areas in terms of markets were West Central Oregon (20 percent) and Southwest Oregon (15 percent).

The Lower Columbia Area with its advantageous location with respect to timber resources, transportation, and markets led all other areas in shipments of residues to pulp and board mills. This area accounted for 33 percent of west coast shipments, followed by the West Central Oregon Area with 20 percent.

Sixty-nine percent of the volume of shipments from west coast lumber, veneer, and plywood mills were to pulp and board mills within the area of shipment. It follows, of course, that the same percentage of receipts by pulp and board mills were within-area. However, there were substantial variations among areas in the extent that their shipments and receipts were within-area. Northwest Washington and Coastal California provided markets for practically all residues shipped from their lumber, veneer, and plywood mills. On the other hand, Eastern Oregon, which has only four board mills and no pulpmills, had a market for only 19 percent of the residue shipments; the remainder, of course, went to other areas. From the standpoint of receipts by pulp and board mills, the leading areas in terms of percentage of their material coming from within-area mills were Interior California (96 percent) and Northwest Washington (84 percent); the

[9] All average distances shown in this report were derived by weighting distance of movement by tonnage involved.

[10] Onsite transportation consists of conveyor systems and forced-air pipelines for the short-distance movement of residues from producing sources to pulp or board stockpiles within a mill complex or to nearby export facilities. Actual distances undoubtedly averaged less than the 1 mile arbitrarily assigned to all such movements.

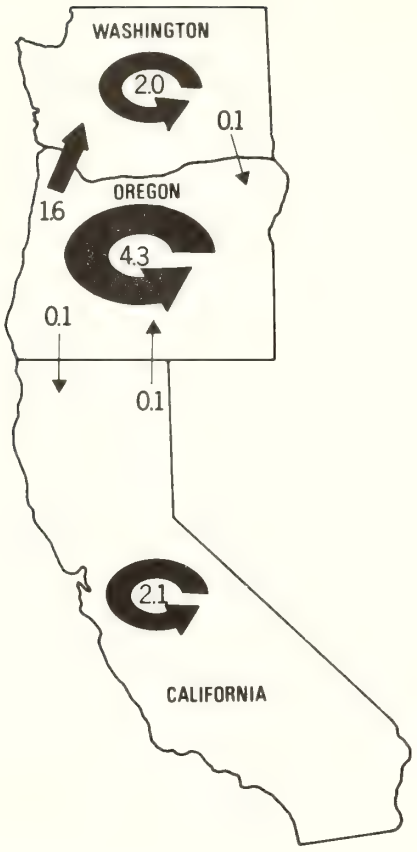


Figure 2.—Shipments (million tons) to pulp and board mills within and between States, 1968.

Eastern Washington Area was low in this respect with only 46 percent coming from within the area.

Shipments to pulp and board mills mainly from lumber mills; trucks the principal carrier

Seventy-four percent of the shipments to pulp and board mills come from lumber mills and 26 percent from veneer and plywood mills (table 7). The relative importance of the two sources of shipments varied considerably among areas depending largely on the number and size of mills of each type; only in Southwest Oregon did veneer and plywood mills come close to lumber mills as a source of supply--49 percent.

The relative importance of the various types of carrier depended in large measure on distance of shipment. However, as shown by the following tabulation (based on table 7), trucking was the most important individual method:

Carrier	Amount	Average distance
	(Percent)	(Miles)
Truck	50	37
Rail	35	147
Barge	6	59
Onsite	9	1
All carriers	100	73

Because of economies in shipping costs, railroads were more important for longer shipments. For example, shipments from the Eastern Washington Area to the Northwest Washington and Lower Columbia Areas were of much longer than average distance for the west coast and were all made by rail.

Opportunities to use barge and rail transportation were relatively limited or nonexistent in some areas. Barge shipments were not generally feasible in California or Eastern Oregon. In the Coastal California Area a lack of east-west rail lines and no rail lines extending north of Eureka resulted in only 6 percent of residues moving by rail.

Pulpmills a much bigger market than board mills

Pulpmills, with their production capacity much greater than board mills (table 4), consumed by far the greater proportion (83 percent) of the residues that went to pulp and board mills in 1968 (tables 8 and 9 and figs. 3-5). As shown by the

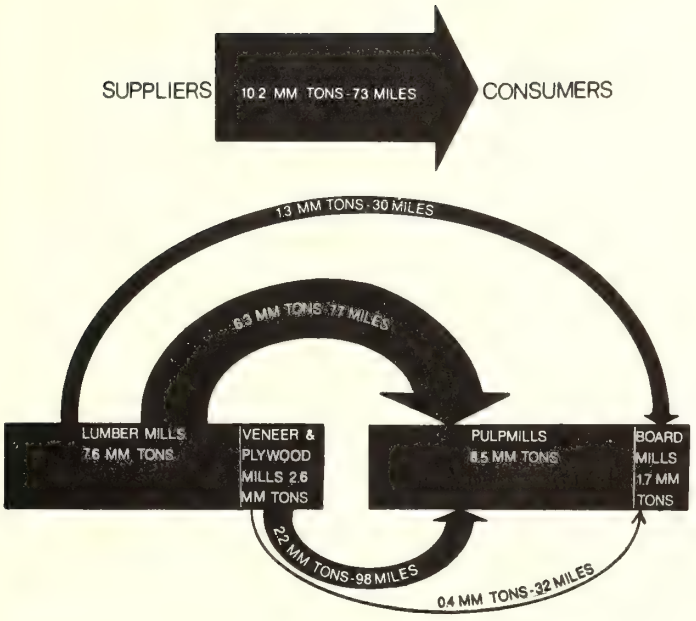


Figure 3.—Amount and average distance of shipment of residues between types of mills, 1968.

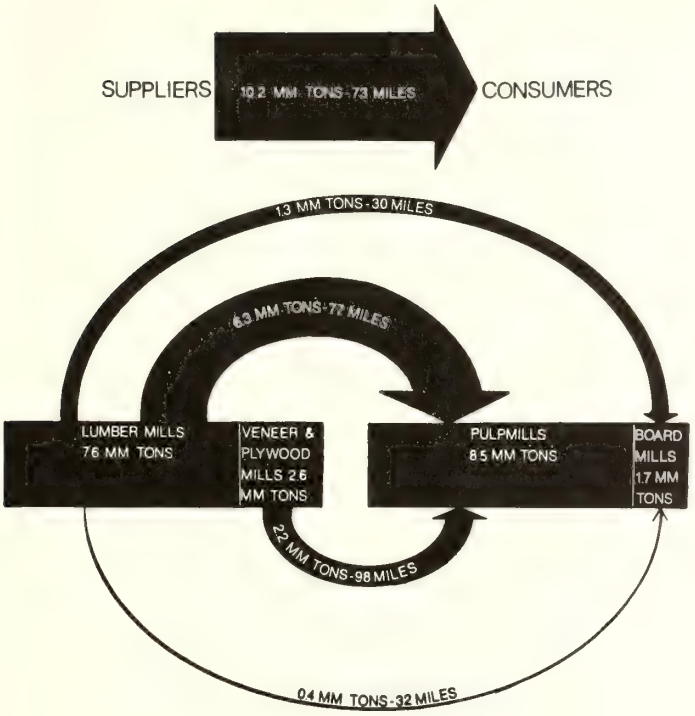
following breakdown, the board mill market for residues was greater than the pulpmill market in only three areas.

Area	Residue receipts by: Pulpmills	Board mills
	(Thousand tons)	
Northwest Washington	1,062	21
Lower Columbia	3,266	150
West Central Oregon	1,692	342
Southwest Oregon	455	564
Coastal California	1,467	304
Eastern Washington	405	--
Eastern Oregon	--	163
Interior California	168	200
Total	8,515	1,744

Shipments to pulpmills differed from those to board mills in that they were longer (by both truck and rail) and a larger proportion went by rail (tables 8 and 9 and fig. 6). These differences largely reflect the greater distances that pulpmills generally reach out for material because of their much bigger consumption per mill. Another reason is that pulpmills are less flexible as to location in relation to sources of supply; they must have substantial volumes of water and have greater needs for rail and water transportation.

Type of carrier and average distance of shipment related to mill ownership

One of the objectives of this study was to assess ownership affiliation of mills as a factor influencing type of carrier and average distance of residue shipment. In other words, do type of carrier and average distance between residue generating and consuming mills that have common ownership differ from carrier and distance between mills of unrelated ownership?



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Interior California	168	200
Total	8,515	1,744

Shipments to pulpmills differed from those to board mills in that they were longer (by both truck and rail) and a larger proportion went by rail (tables 8 and 9 and fig. 6). These differences largely reflect the greater distances that pulpmills generally reach out for material because of their much bigger consumption per mill. Another reason is that pulpmills are less flexible as to location in relation to sources of supply; they must have substantial volumes of water and have greater needs for rail and water transportation.

Type of carrier and average distance of shipment related to mill ownership

One of the objectives of this study was to assess ownership affiliation of mills as a factor influencing type of carrier and average distance of residue shipment. In other words, do type of carrier and average distance between residue generating and consuming mills that have common ownership differ from carrier and distance between mills of unrelated ownership?

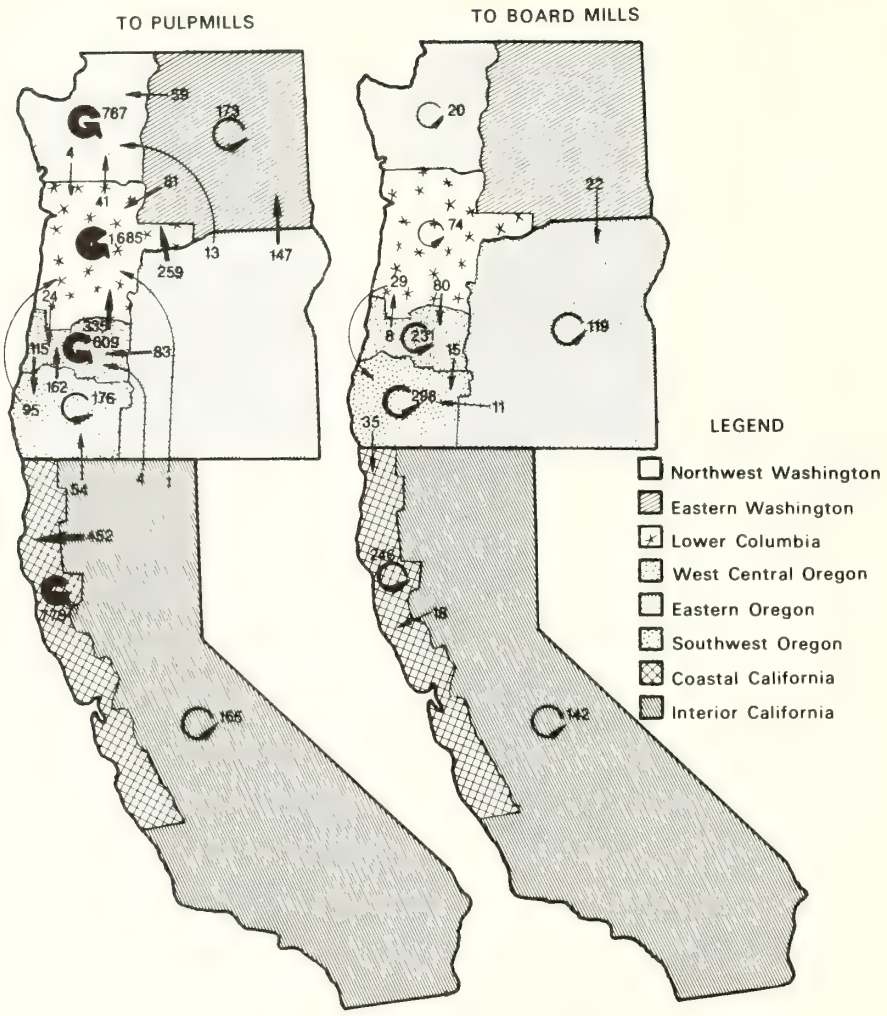

Figure 4.—Shipments (thousand tons) from lumber mills to pulpmills and board mills within and between areas, 1968.

Twenty-five percent of the 10.3 million tons of residues going to pulp and board mills came from sawmills and veneer and plywood mills of the same ownership (table 10). The proportion varied among areas from a high of 41 percent for Northwest Washington to a low of 20 percent for Eastern Oregon. Percentage of west coast shipments to mills of the same ownership was as follows:

Shipping mills	Consuming mills: Pulp	Board	All
	--- Percent ---		
Lumber	23	20	22
Veneer and plywood	25	79	33
Average	23	33	25

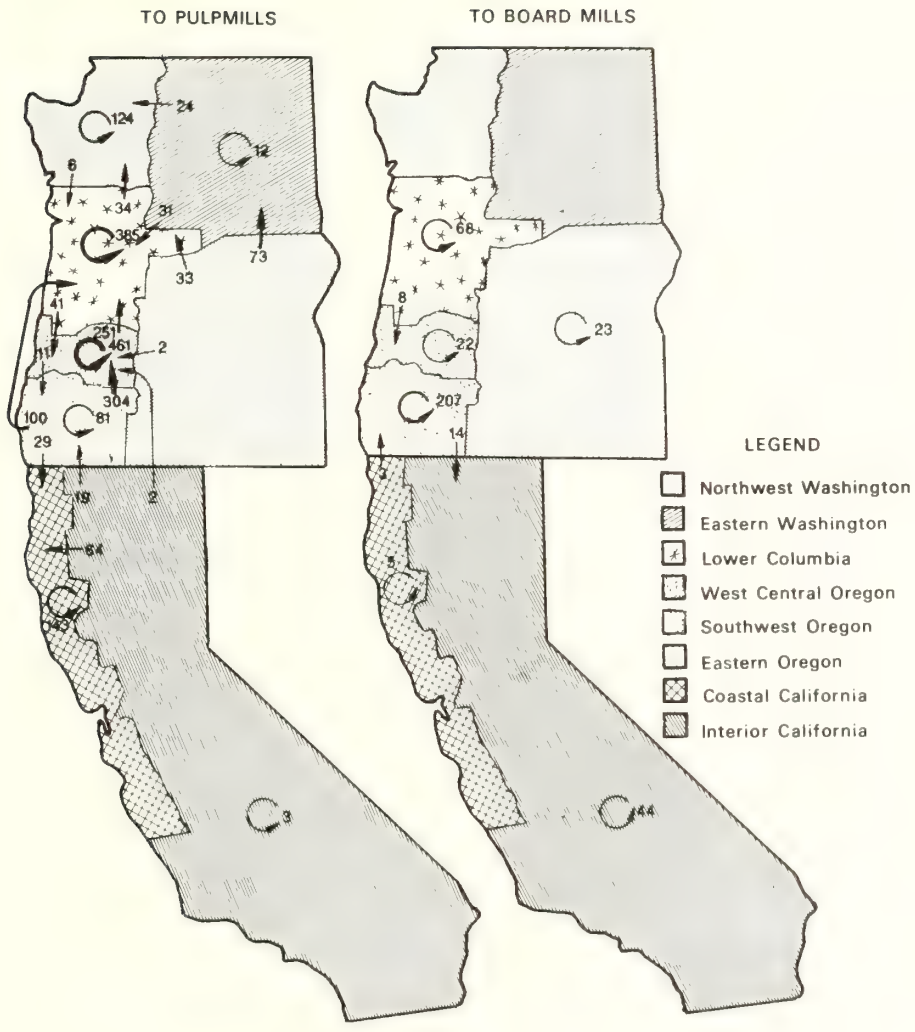

Figure 5.–Shipments (thousand tons) from veneer and plywood mills to pulpmills and board mills within and between areas, 1968.

Differences exist between the two ownership classes in use of types of carrier and average distance of shipments.

Carrier	Same ownership	
	Shipments (Percent)	Distance (Miles)
Truck	33	24
Rail	33	125
Barge	3	40
Onsite	31	1
All carriers	100	50

Carrier	Different ownership	
	Shipments (Percent)	Distance (Miles)
Truck	55	40
Rail	36	154
Barge	7	61
Onsite	2	1
All carriers	100	82

A principal reason for the differences shown above is that many mills of the same ownership are physically close together as

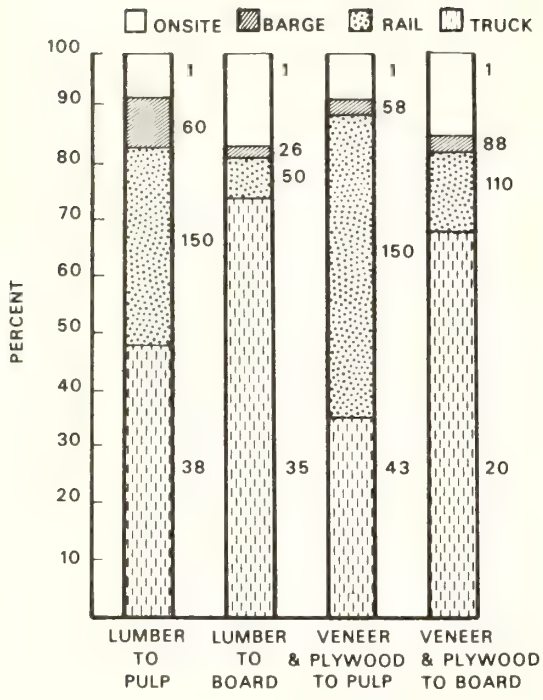

Figure 6.—Residue shipments—types of mills—carriers—average distances—1968. (Numbers are average distance in miles.)

components of integrated operations and can use onsite equipment to move residues. Undoubtedly residues were an important consideration by many large pulp companies in acquisition of mills. Comparisons similar to the above tabulation can also be made for individual areas; however, only average distances by ownership classes are summarized here:

Area	Mill ownership	
	Same	Different
	---- Miles ----	
Northwest Washington	15	34
Lower Columbia	28	49
West Central Oregon	22	63
Southwest Oregon	53	114
Coastal California	31	47
Eastern Washington	214	205
Eastern Oregon	130	170
Interior California	66	129
Average	50	82

It is apparent from the above that only the Eastern Washington Area shows a greater distance for shipments between mills of the same ownership. This stems from the fact that most shipments go long distances (no onsite shipments) and differences in ownership are washed out.

Type of carrier and average distance of shipment related to sawmill size

Almost half the 7.6 million tons of residues shipped by sawmills to pulp and board plants in 1968 came from sawmills of the largest size class. This is shown by table 11 which is summarized as follows:

Mill-size class (Board-foot capacity per 8 hours)	Percent
120,000 plus	49
80,000-119,000	31
40,000-79,000	18
Less than 40,000	2
Total	100

The two areas in California were the only ones in which the 120,000-bd. ft. plus mills did not lead in residue output; in these areas, 80,000-to 119,000-bd. ft. mills shipped the greatest amount--45 percent in both cases. This results from California's comparatively few largest class mills in relation to the second class --less than half as many (table 2).

The percentage of shipments that went by each carrier type, as well as the average distance of such shipments, varied substantially from one mill-size class to another (table 11 and fig. 7). Truck use decreased in relative importance with increasing mill size. Onsite transport was important principally to large mills. For all mill-size classes, trucking was of greater importance for shipments to board mills than to pulpmills; this

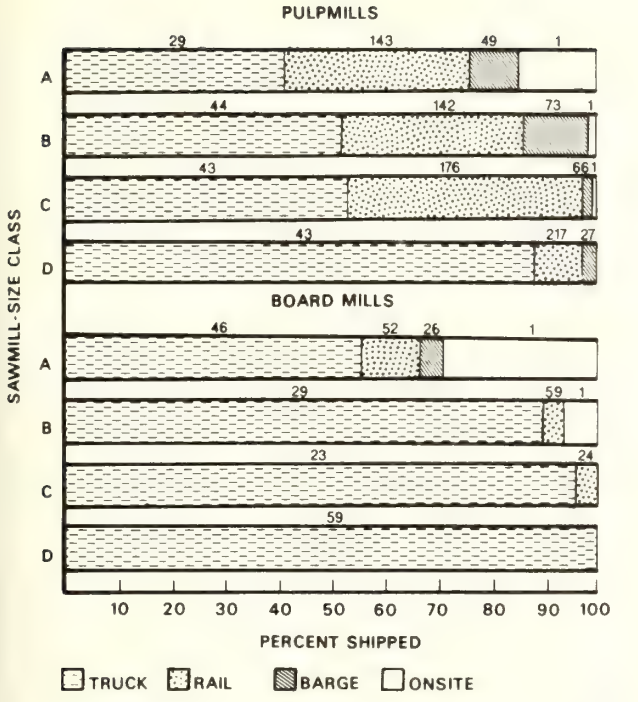

Figure 7.—Residue shipments—sawmill-size classes—types of consuming mills—average distances—1968.
(Numbers are average distance in miles.)

occurred even where trucking distances to board mills were greater.

Large volume of wood residues unused or used for fuel

More than 9 million tons of residues suitable for pulp and board use that were generated by lumber and veneer and plywood mills were either unused (47 percent) or went for fuel (53 percent) in 1968 (table 12). More than four-fifths of this material was sawmill residue, the remainder from veneer and plywood mills. Following is a breakdown by type and industry source of unused residue and residue used for fuel.

Industry	Type of residue[1] 1/ Coarse	Medium	Fine	Total
	----- Thousand tons -----			
Lumber	2,208	1,692	3,743	7,643
Veneer and plywood	1,446	--	174	1,620
Total	3,654	1,692	3,917	9,263

As shown below, the Interior California Area had the largest total volume of unused and burned sawmill residues; West Central Oregon had the largest volume of similar material from veneer and plywood mills.

Area	Industry Lumber	Veneer and plywood	Total
	-- Thousand tons --		
Northwest Washington	773	289	1,062
Lower Columbia	1,002	214	1,216
West Central Oregon	760	464	1,224
Southwest Oregon	763	371	1,134
Coastal California	1,159	130	1,289
Eastern Washington	414	14	428
Eastern Oregon	798	50	848
Interior California	1,974	88	2,062
Total	7,643	1,620	9,263

The high volume shown above for Interior California results to a considerable extent from the relatively large proportion (75 percent) of the smaller mills that did not utilize residues for pulp or board (table 2). In the Coastal California Area, which also had a large volume of unused and fuelwood residues, 73 percent of smaller mills did not utilize residues for pulp or board.

The 1968 volume of 4 million tons of unused material and 5 million tons that went for fuel characterize the potential

[1] See footnotes 1, 2, and 3 to table 12.

additional annual supply suitable for pulp and board manufacture. Reasons that some or all of this material did not go for such use varied with individual mills. Some of the mills--principally the smaller ones--did not feel it profitable to install equipment for chipping residues in excess of their fuel needs or markets. Other mills shipped part of their residues to pulp and board mills or export but felt it advantageous to use part or all of the remainder for industrial fuel. In the future, a greater proportion of residues will undoubtedly go to pulp and board mills or export if prices for such material increase in relation to shipping costs and values for other uses, especially fuel.

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Table 1.—Number of mills by type of mill, area, and State, 1968

Area and State	Type of mill												
	Lumber		Veneer and plywood[1/]		Pulp[2/]					Board			
	All	Producing residues for pulp and board	All	Producing residues for pulp and board	All	Sulfite	Sulfate	Ground-wood	Semi-chemical	All	Hard-board	Particle-board	Insulation board
Northwest Washington	100	44	20	12	16	7	5	3	1	2	1	--	1
Lower Columbia	151	88	35	33	22	7	7	7	1	4	2	1	1
West Central Oregon	79	62	46	39	4	1	3	--	--	9	4	5	--
Southwest Oregon	72	54	41	40	3	1	1	--	1	5	1	4	--
Coastal California	93	55	16	15	5	--	3	1	1	3	1	2	--
Eastern Washington	58	26	4	3	4	1	1	1	1	--	--	--	--
Eastern Oregon	52	27	9	8	--	--	--	--	--	4	[3/]2	2	--
Interior California	123	55	9	9	3	--	1	2	--	3	--	3	--
Washington	212	97	38	29	32	11	11	7	3	3	1	1	1
Oregon	300	204	117	106	17	6	6	4	1	21	9	11	1
California	216	110	25	24	8	--	4	3	1	6	1	5	--
Total, west coast	728	411	180	159	57	17	21	14	5	30	11	17	2

[1/] Not included are 27 mills (5 in Washington, 21 in Oregon, and 1 in California) that lay up plywood only from veneer produced in other mills and therefore do not generate significant amounts of residue.

[2/] Not included are 3 mills in California that manufacture roofing felt.

[3/] 1 mill also manufactures insulation board.

Table 2.—Number of sawmills by mill-size class, area, and State, 1968

Area and State	Mill-size class[1/]								All classes	
	D		C		B		A			
	All	Producing residues for pulp and board	All	Producing residues for pulp and board	All	Producing residues for pulp and board	All	Producing residues for pulp and board	All	Producing residues for pulp and board
Northwest Washington	68	15	11	9	8	8	13	12	100	44
Lower Columbia	77	18	33	30	19	19	22	21	151	88
West Central Oregon	22	9	20	19	21	18	16	16	79	62
Southwest Oregon	20	3	9	8	23	23	20	20	72	54
Coastal California	23	1	26	12	27	26	17	16	93	55
Eastern Washington	29	5	19	13	7	5	3	3	58	26
Eastern Oregon	13	1	20	12	10	6	9	8	52	27
Interior California	26	1	43	16	40	25	14	13	123	55
Washington	127	25	42	33	19	17	24	22	212	97
Oregon	102	26	70	58	69	62	59	58	300	204
California	49	2	69	28	67	51	31	29	216	110
Total, west coast	278	53	181	119	155	130	114	109	728	411

[1/] Mill-size classes identified as follows: Class A mills = 120,000+ board-foot capacity per 8-hour shift; B = 80,000-119,000; C = 40,000-79,000; D = less than 40,000.

Table 3.—Installed 8-hour capacity of sawmills and veneer and plywood mills by type of mill, sawmill-size class, area, and State, 1968

Area and State	Sawmills					Veneer and plywood mills[2/]	
	All sawmills	Mill-size class[1/]				Veneer only	Veneer and layup
		D	C	B	A		
	Thousand board feet					*Thousand square feet, 3/8-inch basis*	
Northwest Washington	4,741	822	628	760	2,531	623	1,908
Lower Columbia	8,630	932	1,756	1,810	4,132	2,760	4,418
West Central Oregon	6,679	394	1,208	2,000	3,077	3,508	4,821
Southwest Oregon	6,625	343	460	2,142	3,680	5,760	6,918
Coastal California	7,056	335	1,534	2,452	2,735	1,122	816
Eastern Washington	2,716	555	1,061	600	500	230	262
Eastern Oregon	4,164	144	1,265	905	1,850	492	530
Interior California	9,013	310	2,558	3,625	2,520	714	757
Washington	10,611	1,698	2,337	1,750	4,826	2,246	4,993
Oregon	22,944	1,492	4,041	6,467	10,944	11,127	13,864
California	16,069	645	4,092	6,077	5,255	1,836	1,573
Total, west coast	49,624	3,835	10,470	14,294	21,025	15,209	20,430

[1/] Mill-size classes identified as follows: Class A mills = 120,000+ board-foot capacity per 8-hour shift; B = 80,000-119,000; C = 40,000-79,000; D = less than 40,000.

[2/] Not included are 27 mills with a combined capacity of 5,671,000 square feet (3/8-inch basis) that laid up only plywood from veneer produced in other mills and therefore did not generate significant amounts of residue.

Table 4.—Installed 24-hour capacity of pulp and board mills by type of mill, area, and State, 1968

(Tons)

Area and State	Type of pulpmill[1/]					Type of board mill				All pulp and board mills
	All types	Sulfite	Sulfate	Ground-wood	Semi-chemical	All types	Hard-board	Particle-board	Insulation board	
Northwest Washington	5,862	3,227	1,380	795	460	180	50	--	130	6,042
Lower Columbia	8,303	1,763	4,600	1,715	225	338	172	16	150	8,641
West Central Oregon	2,705	95	2,610	--	--	3,593	2,487	1,106	--	6,298
Southwest Oregon	890	85	550	--	255	1,430	190	1,240	--	2,320
Coastal California	2,055	--	1,790	40	225	890	450	440	--	2,945
Eastern Washington	740	80	450	40	170	--	--	--	--	740
Eastern Oregon	--	--	--	--	--	845	[2/]295	550	--	845
Interior California	325	--	150	175	--	570	--	570	--	895
Washington	11,020	4,210	4,930	1,025	855	196	50	16	130	11,216
Oregon	7,480	1,040	4,660	1,525	255	6,190	3,144	2,896	150	13,670
California	2,380	--	1,940	215	225	1,460	450	1,010	--	3,840
Total, west coast	20,880	5,250	11,530	2,765	1,335	7,846	3,644	3,922	280	28,726

[1/] Not included are 3 mills in California that manufacture roofing felt.

[2/] 155 tons of capacity can be used interchangeably to produce insulation board.

Table 5.—Amount and average distance of shipment of residues for pulp and board use, by area of origin, type of shipping mill, carrier, and type of destination, 1968

(Also on pages 18 and 19)

Area of origin and type of shipping mill	Carrier	Type of destination							
		Pulp and board mills		Export[1/]		Other		All types	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
Northwest Washington:									
Lumber	Truck	459,999	5	--	--	--	--	459,999	5
	Rail	147,647	49	--	--	--	--	147,647	49
	Barge	175,934	64	--	--	--	--	175,934	64
	Onsite	8,143	1	38,076	1	--	--	46,219	1
	Total	791,723	26	38,076	1	--	--	829,799	25
Veneer and plywood	Truck	68,956	2	--	--	--	--	68,956	2
	Rail	32,046	56	--	--	--	--	32,046	56
	Barge	28,800	46	--	--	--	--	28,800	46
	Onsite	--	--	--	--	--	--	--	--
	Total	129,802	25	--	--	--	--	129,802	25
All types	Truck	528,955	5	--	--	--	--	528,955	5
	Rail	179,693	50	--	--	--	--	179,693	50
	Barge	204,734	61	--	--	--	--	204,734	61
	Onsite	8,143	1	38,076	1	--	--	46,219	1
	Total	921,525	26	38,076	1	--	--	959,601	25
Lower Columbia:									
Lumber	Truck	1,154,058	38	94,315	8	--	--	1,248,373	36
	Rail	247,047	80	--	--	--	--	247,047	80
	Barge	343,374	62	--	--	--	--	343,374	62
	Onsite	188,777	1	--	--	--	--	188,777	1
	Total	1,933,256	44	94,315	8	--	--	2,027,571	43
Veneer and plywood	Truck	309,205	43	--	--	--	--	309,205	43
	Rail	153,901	64	--	--	--	--	153,901	64
	Barge	27,000	53	--	--	--	--	27,000	53
	Onsite	45,736	1	--	--	--	--	45,736	1
	Total	535,842	46	--	--	--	--	535,842	46
All types	Truck	1,463,263	39	94,315	8	--	--	1,557,578	37
	Rail	400,948	74	--	--	--	--	400,948	74
	Barge	370,374	61	--	--	--	--	370,374	61
	Onsite	234,513	1	--	--	--	--	234,513	1
	Total	2,469,098	45	94,315	8	--	--	2,563,413	43
West Central Oregon:									
Lumber	Truck	696,291	28	--	--	--	--	696,291	28
	Rail	452,662	84	17,207	196	--	--	469,869	88
	Barge	22,255	4	--	--	--	--	22,255	4
	Onsite	141,574	1	--	--	--	--	141,574	1
	Total	1,312,782	44	17,207	196	--	--	1,329,989	46
Veneer and plywood	Truck	276,491	37	48,000	49	--	--	324,491	39
	Rail	391,694	107	17,468	180	--	--	409,162	110
	Barge	--	--	--	--	--	--	--	--
	Onsite	77,097	1	--	--	--	--	77,097	1
	Total	745,282	70	65,468	84	--	--	810,750	71
All types	Truck	972,782	31	48,000	49	--	--	1,020,782	32
	Rail	844,356	94	34,675	188	--	--	879,031	98
	Barge	22,255	4	--	--	--	--	22,255	4
	Onsite	218,671	1	--	--	--	--	218,671	1
	Total	2,058,064	53	82,675	107	--	--	2,140,739	55

1/ See footnote at end of table.

Table 5.—Amount and average distance of shipment of residues for pulp and board use, by area of origin, type of shipping mill, carrier, and type of destination, 1968—Continued

Area of origin and type of shipping mill	Carrier	Type of destination							
		Pulp and board mills		Export[1/]		Other		All types	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
Southwest Oregon:									
Lumber	Truck	394,623	32	448,326	69	--	--	842,949	52
	Rail	226,654	187	13,082	13	--	--	239,736	177
	Barge	18,000	2	--	--	--	--	18,000	2
	Onsite	127,327	1	265,585	1	--	--	392,912	1
	Total	766,604	72	726,993	43	--	--	1,493,597	58
Veneer and plywood	Truck	214,168	24	296,671	68	--	--	510,839	50
	Rail	454,729	190	--	--	--	--	454,729	190
	Barge	29,600	86	--	--	--	--	29,600	86
	Onsite	37,756	1	47,717	1	--	--	85,473	1
	Total	736,253	128	344,388	59	--	--	1,080,641	106
All types	Truck	608,791	29	744,997	69	--	--	1,353,788	51
	Rail	681,383	189	13,082	13	--	--	694,465	185
	Barge	47,600	54	--	--	--	--	47,600	54
	Onsite	165,083	1	313,302	1	--	--	478,385	1
	Total	1,502,857	99	1,071,381	48	--	--	2,574,238	78
Coastal California:									
Lumber	Truck	903,315	43	--	--	4,800	73	908,115	43
	Rail	61,969	81	--	--	6,800	142	68,769	87
	Barge	--	--	--	--	--	--	--	--
	Onsite	59,381	1	--	--	--	--	59,381	1
	Total	1,024,665	43	--	--	11,600	113	1,036,265	44
Veneer and plywood	Truck	123,206	52	13,616	141	--	--	136,822	61
	Rail	4,640	59	--	--	--	--	4,640	59
	Barge	--	--	--	--	--	--	--	--
	Onsite	22,800	1	--	--	--	--	22,800	1
	Total	150,646	45	13,616	141	--	--	164,262	53
All types	Truck	1,026,521	44	13,616	141	4,800	73	1,044,937	45
	Rail	66,609	79	--	--	6,800	142	73,409	85
	Barge	--	--	--	--	--	--	--	--
	Onsite	82,181	1	--	--	--	--	82,181	1
	Total	1,175,311	43	13,616	141	11,600	113	1,200,527	45
Eastern Washington:									
Lumber	Truck	54,502	153	--	--	--	--	54,502	153
	Rail	280,718	198	--	--	--	--	280,718	198
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	335,220	191	--	--	--	--	335,220	191
Veneer and plywood	Truck	--	--	--	--	--	--	--	--
	Rail	66,850	293	--	--	--	--	66,850	293
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	66,850	293	--	--	--	--	66,850	293
All types	Truck	54,502	153	--	--	--	--	54,502	153
	Rail	347,568	216	--	--	--	--	347,568	216
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	402,070	208	--	--	--	--	402,070	208

[1/] See footnote at end of table.

Table 5.—Amount and average distance of shipment of residues for pulp and board use, by area of origin, type of shipping mill, carrier, and type of destination, 1968—Continued

Area of origin and type of shipping mill	Carrier	Type of destination							
		Pulp and board mills		Export[1/]		Other		All types	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
Eastern Oregon:									
Lumber	Truck	113,125	62	--	--	--	--	113,125	62
	Rail	471,667	207	--	--	--	--	471,667	207
	Barge	--	--	--	--	--	--	--	--
	Onsite	46,600	1	--	--	--	--	46,600	1
	Total	631,392	166	--	--	--	--	631,392	166
Veneer and plywood	Truck	37,058	52	--	--	--	--	37,058	52
	Rail	93,513	179	--	--	--	--	93,513	179
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	130,571	143	--	--	--	--	130,571	143
All types	Truck	150,183	59	--	--	--	--	150,183	59
	Rail	565,180	202	--	--	--	--	565,180	202
	Barge	--	--	--	--	--	--	--	--
	Onsite	46,600	1	--	--	--	--	46,600	1
	Total	761,963	162	--	--	--	--	761,963	162
Interior California:									
Lumber	Truck	260,279	59	105,178	105	--	--	365,457	72
	Rail	437,162	168	--	--	--	--	437,162	168
	Barge	--	--	--	--	--	--	--	--
	Onsite	138,464	1	--	--	--	--	138,464	1
	Total	835,905	107	105,178	105	--	--	941,083	106
Veneer and plywood	Truck	21,100	89	13,000	137	--	--	34,100	107
	Rail	66,682	162	--	--	--	--	66,682	162
	Barge	--	--	--	--	--	--	--	--
	Onsite	44,015	1	--	--	--	--	44,015	1
	Total	131,797	96	13,000	137	--	--	144,797	100
All types	Truck	281,379	62	118,178	108	--	--	399,557	75
	Rail	503,844	167	--	--	--	--	503,844	167
	Barge	--	--	--	--	--	--	--	--
	Onsite	182,479	1	--	--	--	--	182,479	1
	Total	967,702	105	118,178	108	--	--	1,085,880	106
Total, west coast:									
Lumber	Truck	4,036,192	37	647,819	66	4,800	73	4,688,811	41
	Rail	2,325,526	146	30,289	117	6,800	142	2,362,615	145
	Barge	559,563	58	--	--	--	--	559,563	58
	Onsite	710,266	1	303,661	1	--	--	1,013,927	1
	Total	7,631,547	68	981,769	47	11,600	113	8,624,916	66
Veneer and plywood	Truck	1,050,184	37	371,287	71	--	--	1,421,471	46
	Rail	1,264,055	148	17,468	180	--	--	1,281,523	148
	Barge	85,400	62	--	--	--	--	85,400	62
	Onsite	227,404	1	47,717	1	--	--	275,121	1
	Total	2,627,043	88	436,472	68	--	--	3,063,515	85
All types	Truck	5,086,376	37	1,019,106	68	4,800	73	6,110,282	42
	Rail	3,589,581	147	47,757	140	6,800	142	3,644,138	147
	Barge	644,963	59	--	--	--	--	644,963	59
	Onsite	937,670	1	351,378	1	--	--	1,289,048	1
	Total	10,258,590	73	1,418,241	54	11,600	113	11,688,431	71

[1/] Consists of residues reported as going directly from lumber mills and veneer and plywood mills to export; not included are volumes of residues exported by pulp and board mills.

Table 6.—Flows of residues to pulp and board mills by State of origin, type of shipping mill, carrier, and State of destination, 1968

(Also next page)

State of origin and type of shipping mill	Carrier	State of destination							
		Washington		Oregon		California		Total, all States	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
Washington:									
Lumber	Truck	785,935	18	21,839	195	--	--	807,774	23
	Rail	470,950	131	29,325	239	--	--	500,275	138
	Barge	228,534	63	20,800	143	--	--	249,334	69
	Onsite	161,928	1	--	--	--	--	161,928	1
	Total	1,647,347	55	71,964	198	--	--	1,719,311	61
Veneer and plywood	Truck	174,326	26	--	--	--	--	174,326	26
	Rail	130,521	86	27,000	463	--	--	157,521	151
	Barge	41,400	59	--	--	--	--	41,400	59
	Onsite	45,736	1	--	--	--	--	45,736	1
	Total	391,983	46	27,000	463	--	--	418,983	73
All types	Truck	960,261	20	21,839	1	--	--	982,100	24
	Rail	601,471	122	56,325	346	--	--	657,796	141
	Barge	269,934	62	20,800	143	--	--	290,734	68
	Onsite	207,664	1	--	--	--	--	207,664	1
	Total	2,039,330	53	98,964	270	--	--	2,138,294	63
Oregon:									
Lumber	Truck	392,688	51	1,636,856	34	35,280	31	2,064,824	37
	Rail	556,691	195	769,429	108	--	--	1,326,120	145
	Barge	154,167	59	156,062	40	--	--	310,229	49
	Onsite	--	--	350,493	1	--	--	350,493	1
	Total	1,103,546	125	2,912,840	50	35,280	31	4,051,666	70
Veneer and plywood	Truck	79,651	98	651,901	28	--	--	731,552	36
	Rail	360,921	146	660,083	144	14,208	316	1,035,212	147
	Barge	5,600	46	8,800	9	29,600	1	44,000	65
	Onsite	--	--	114,853	1	--	--	114,853	1
	Total	446,172	136	1,435,637	79	43,808	160	1,925,617	94
All types	Truck	472,339	59	2,288,757	32	35,280	31	2,796,376	37
	Rail	917,612	176	1,429,512	125	14,208	316	2,361,332	146
	Barge	159,767	58	164,862	38	29,600	86	354,229	51
	Onsite	--	--	465,346	1	--	--	465,346	1
	Total	1,549,718	128	4,348,477	59	79,088	103	5,977,283	78

Table 6.—Flows of residues to pulp and board mills by State of origin, type of shipping mill, carrier, and State of destination, 1968—Continued

State of origin and type of shipping mill	Carrier	State of destination							
		Washington		Oregon		California		Total, all States	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
California:		Tons	Miles	Tons	Miles	Tons	Miles	Tons	Miles
Lumber	Truck	--	--	--	--	1,163,594	47	1,163,594	47
	Rail	--	--	59,237	234	439,894	147	499,131	157
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	197,845	1	197,845	1
	Total	--	--	59,237	234	1,801,333	66	1,860,570	71
Veneer and plywood	Truck	--	--	3,285	141	141,021	56	144,306	58
	Rail	--	--	20,733	249	50,589	117	71,322	155
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	66,815	1	66,815	1
	Total	--	--	24,018	235	258,425	53	282,443	69
All types	Truck	--	--	3,285	141	1,304,615	48	1,307,900	48
	Rail	--	--	79,970	238	490,483	144	570,453	157
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	264,660	1	264,660	1
	Total	--	--	83,255	234	2,059,758	65	2,143,013	71
Total, west coast:									
Lumber	Truck	1,178,623	29	1,658,695	36	1,198,874	46	4,036,192	37
	Rail	1,027,641	166	857,991	121	439,894	147	2,325,526	146
	Barge	382,701	61	176,862	52	--	--	559,563	58
	Onsite	161,928	1	350,493	1	197,845	1	710,266	1
	Total	2,750.893	83	3,044,041	57	1,836,613	65	7,631,547	68
Veneer and plywood	Truck	253,977	48	655,186	28	141,021	56	1,050,184	37
	Rail	491,442	130	707,816	159	64,797	160	1,264,055	148
	Barge	47,000	57	8,800	9	29,600	86	85,400	62
	Onsite	45,736	1	114,853	1	66,815	1	227,404	1
	Total	838,155	94	1,486,655	88	302,233	69	2,627,043	88
All types	Truck	1,432,600	33	2,313,881	34	1,339,895	47	5,086,376	37
	Rail	1,519,083	154	1,565,807	139	504,691	149	3,589,581	147
	Barge	429,701	60	185,662	50	29,600	86	644,963	59
	Onsite	207,664	1	465,346	1	264,660	1	937,670	1
	Total	3,589,048	86	4,530,696	67	2,138,846	66	10,258,590	73

Table 7.–Flows of residues to pulp and board mills by

(Continued through page 27)

Area of origin and type of shipping mill	Carrier	Northwest Washington		Lower Columbia		West Central Oregon		Southwest Oregon	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Ave dis
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Mi*
Northwest Washington:									
Lumber	Truck	457,799	5	2,200	99	--	--	--	
	Rail	145,647	49	2,000	109	--	--	--	
	Barge	175,934	64	--	--	--	--	--	
	Onsite	8,143	1	--	--	--	--	--	
	Total	787,523	26	4,200	104	--	--	--	
Veneer and plywood	Truck	68,956	2	--	--	--	--	--	
	Rail	25,944	47	6,102	93	--	--	--	
	Barge	28,800	46	--	--	--	--	--	
	Onsite	--	--	--	--	--	--	--	
	Total	123,700	21	6,102	93	--	--	--	
All types	Truck	526,755	5	2,200	99	--	--	--	
	Rail	171,591	48	8,102	97	--	--	--	
	Barge	204,734	61	--	--	--	--	--	
	Onsite	8,143	1	--	--	--	--	--	
	Total	911,223	26	10,302	97	--	--	--	
Lower Columbia:									
Lumber	Truck	32,677	46	1,010,010	35	89,931	45	21,440	1
	Rail	8,333	152	217,334	76	13,863	4	7,517	2
	Barge	--	--	343,374	62	--	--	--	
	Onsite	--	--	188,777	1	--	--	--	
	Total	41,010	68	1,759,495	42	103,794	44	28,957	2
Veneer and plywood	Truck	33,624	73	230,005	41	45,576	33	--	
	Rail	--	--	150,253	65	3,648	23	--	
	Barge	--	--	27,000	54	--	--	--	
	Onsite	--	--	45,736	1	--	--	--	
	Total	33,624	73	452,994	46	49,224	32	--	
All types	Truck	66,301	60	1,240,015	36	135,507	41	21,440	1
	Rail	8,333	152	367,587	72	17,511	35	7,517	2
	Barge	--	--	370,374	62	--	--	--	
	Onsite	--	--	234,513	1	--	--	--	
	Total	74,634	70	2,212,489	42	153,018	40	28,957	2
West Central Oregon:									
Lumber	Truck	--	--	148,197	73	495,541	15	52,553	
	Rail	--	--	194,562	151	181,060	29	77,040	
	Barge	--	--	--	--	22,255	4	--	
	Onsite	--	--	--	--	141,574	1	--	
	Total	--	--	342,759	118	840,430	15	129,593	
Veneer and plywood	Truck	--	--	33,880	155	242,611	21	--	
	Rail	--	--	217,352	139	163,257	68	11,085	
	Barge	--	--	--	--	--	--	--	
	Onsite	--	--	--	--	77,097	1	--	
	Total	--	--	251,232	141	482,965	33	11,085	
All types	Truck	--	--	182,077	88	738,152	17	52,553	
	Rail	--	--	411,914	145	344,317	48	88,125	
	Barge	--	--	--	--	22,255	4	--	
	Onsite	--	--	--	--	218,671	1	--	
	Total	--	--	593,991	128	1,323,395	22	140,678	

origin, type of shipping mill, carrier, and area of destination, 1968

tination

Coastal California		Eastern Washington		Eastern Oregon		Interior California		Total, all areas	
unt	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
ns	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
--	--	--	--	--	--	--	--	459,999	6
--	--	--	--	--	--	--	--	147,647	49
--	--	--	--	--	--	--	--	175,934	64
--	--	--	--	--	--	--	--	8,143	1
--	--	--	--	--	--	--	--	791,723	26
--	--	--	--	--	--	--	--	68,956	2
--	--	--	--	--	--	--	--	32,046	56
--	--	--	--	--	--	--	--	28,800	46
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	129,802	25
--	--	--	--	--	--	--	--	528,955	5
--	--	--	--	--	--	--	--	179,693	50
--	--	--	--	--	--	--	--	204,734	61
--	--	--	--	--	--	--	--	8,143	1
--	--	--	--	--	--	--	--	921,525	26
--	--	--	--	--	--	--	--	1,154,058	38
--	--	--	--	--	--	--	--	247,047	80
--	--	--	--	--	--	--	--	343,374	62
--	--	--	--	--	--	--	--	188,777	1
--	--	--	--	--	--	--	--	1,933,256	44
--	--	--	--	--	--	--	--	309,205	43
--	--	--	--	--	--	--	--	153,901	64
--	--	--	--	--	--	--	--	27,000	53
--	--	--	--	--	--	--	--	45,736	1
--	--	--	--	--	--	--	--	535,842	46
--	--	--	--	--	--	--	--	1,463,263	39
--	--	--	--	--	--	--	--	400,948	74
--	--	--	--	--	--	--	--	370,374	61
--	--	--	--	--	--	--	--	234,513	1
--	--	--	--	--	--	--	--	2,469,098	45
--	--	--	--	--	--	--	--	696,291	28
--	--	--	--	--	--	--	--	452,662	84
-	--	--	--	--	--	--	--	22,255	4
-	--	--	--	--	--	--	--	141,574	1
-	--	--	--	--	--	--	--	1,312,782	44
-	--	--	--	--	--	--	--	276,491	37
-	--	--	--	--	--	--	--	391,694	107
-	--	--	--	--	--	--	--	--	--
-	--	--	--	--	--	--	--	77,097	1
-	--	--	--	--	--	--	--	745,282	70
-	--	--	--	--	--	--	--	972,782	31
-	--	--	--	--	--	--	--	844,356	94
-	--	--	--	--	--	--	--	22,255	4
-	--	--	--	--	--	--	--	218,671	1
-	--	--	--	--	--	--	--	2,058,064	53

Table 7.–Flows of residues to pulp and board mills by a

Area of origin and type of shipping mill	Carrier	Area							
		Northwest Washington		Lower Columbia		West Central Oregon		Southwest Oregon	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Aver dist
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Mil*
Southwest Oregon:									
Lumber	Truck	--	--	--	--	39,412	130	319,931	
	Rail	--	--	94,878	224	122,894	168	8,882	
	Barge	--	--	--	--	--	--	18,000	
	Onsite	--	--	--	--	--	--	127,327	
	Total	--	--	94,878	224	162,306	159	474,140	
Veneer and plywood	Truck	--	--	--	--	7,008	71	207,160	
	Rail	--	--	99,756	233	297,565	163	43,200	2
	Barge	--	--	--	--	--	--	--	
	Onsite	--	--	--	--	--	--	37,756	
	Total	--	--	99,756	233	304,573	161	288,116	
All types	Truck	--	--	--	--	46,420	121	527,091	
	Rail	--	--	194,634	228	420,459	164	52,082	2
	Barge	--	--	--	--	--	--	18,000	
	Onsite	--	--	--	--	--	--	165,083	
	Total	--	--	194,634	228	466,879	160	762,256	
Coastal California:									
Lumber	Truck	--	--	--	--	--	--	--	
	Rail	--	--	--	--	--	--	--	
	Barge	--	--	--	--	--	--	--	
	Onsite	--	--	--	--	--	--	--	
	Total	--	--	--	--	--	--	--	
Veneer and plywood	Truck	--	--	--	--	--	--	3,285	
	Rail	--	--	--	--	--	--	--	
	Barge	--	--	--	--	--	--	--	
	Onsite	--	--	--	--	--	--	--	
	Total	--	--	--	--	--	--	3,285	
All types	Truck	--	--	--	--	--	--	3,285	
	Rail	--	--	--	--	--	--	--	
	Barge	--	--	--	--	--	--	--	
	Onsite	--	--	--	--	--	--	--	
	Total	--	--	--	--	--	--	3,285	
Eastern Washington:									
Lumber	Truck	--	--	--	--	--	--	--	
	Rail	59,391	148	80,638	307	--	--	--	
	Barge	--	--	--	--	--	--	--	
	Onsite	--	--	--	--	--	--	--	
	Total	59,391	148	80,638	307	--	--	--	
Veneer and plywood	Truck	--	--	--	--	--	--	--	
	Rail	24,300	156	30,550	430	--	--	--	
	Barge	--	--	--	--	--	--	--	
	Onsite	--	--	--	--	--	--	--	
	Total	24,300	156	30,550	430	--	--	--	
All types	Truck	--	--	--	--	--	--	--	
	Rail	83,691	150	111,188	341	--	--	--	
	Barge	--	--	--	--	--	--	--	
	Onsite	--	--	--	--	--	--	--	
	Total	83,691	150	111,188	341	--	--	--	

rigin, type of shipping mill, carrier, and area of destination, 1968–Continued

tination

Coastal California		Eastern Washington		Eastern Oregon		Interior California		Total, all areas	
ount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
ons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
5,280	31	--	--	--	--	--	--	394,623	32
--	--	--	--	--	--	--	--	226,654	187
--	--	--	--	--	--	--	--	18,000	2
--	--	--	--	--	--	--	--	127,327	1
5,280	31	--	--	--	--	--	--	766,604	72
--	--	--	--	--	--	--	--	214,168	24
--	--	--	--	--	--	14,208	1	454,729	190
9,600	86	--	--	--	--	--	--	29,600	86
--	--	--	--	--	--	--	--	37,756	1
9,600	86	--	--	--	--	14,208	1	736,253	128
5,280	31	--	--	--	--	--	--	608,791	29
--	--	--	--	--	--	14,208	1	681,383	189
9,600	86	--	--	--	--	--	--	47,600	54
--	--	--	--	--	--	--	--	165,083	1
4,880	56	--	--	--	--	14,208	1	1,502,857	99
3,315	43	--	--	--	--	--	--	903,315	43
1,969	82	--	--	--	--	--	--	61,969	81
--	--	--	--	--	--	--	--	--	--
9,381	1	--	--	--	--	--	--	59,381	1
4,665	43	--	--	--	--	--	--	1,024,665	43
9,921	50	--	--	--	--	--	--	123,206	52
4,640	59	--	--	--	--	--	--	4,640	59
--	--	--	--	--	--	--	--	--	--
2,800	1	--	--	--	--	--	--	22,800	1
7,361	43	--	--	--	--	--	--	150,646	45
3,236	44	--	--	--	--	--	--	1,026,521	44
6,609	80	--	--	--	--	--	--	66,609	79
--	--	--	--	--	--	--	--	--	--
2,181	1	--	--	--	--	--	--	82,181	1
2,026	43	--	--	--	--	--	--	1,175,311	43
--	--	32,663	125	21,839	195	--	--	54,502	153
--	--	140,689	157	--	--	--	--	280,718	198
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	173,352	151	21,839	195	--	--	335,220	191
--	--	--	--	--	--	--	--	--	--
--	--	12,000	222	--	--	--	--	66,850	293
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	12,000	222	--	--	--	--	66,850	293
--	--	32,663	125	21,839	195	--	--	54,502	153
--	--	152,689	162	--	--	--	--	347,568	216
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	185,352	155	21,839	195	--	--	402,070	208

Table 7.–Flows of residues to pulp and board mills by a

Area of origin and type of shipping mill	Carrier	Area							
		Northwest Washington		Lower Columbia		West Central Oregon		Southwest Oregon	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Avera dista
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Mile*
Eastern Oregon:									
Lumber	Truck	--	--	23,200	110	--	--	11,340	81
	Rail	13,020	405	235,990	236	82,781	173	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	13,020	405	259,190	224	82,781	173	11,340	81
Veneer and plywood	Truck	--	--	9,696	110	1,710	242	--	--
	Rail	--	--	23,199	253	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	32,895	211	1,710	242	--	--
All types	Truck	--	--	32,896	110	1,710	242	11,340	81
	Rail	13,020	405	259,189	237	82,781	173	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	13,020	405	292,085	223	84,491	174	11,340	81
Interior California:									
Lumber	Truck	--	--	--	--	--	--	--	--
	Rail	--	--	1,250	353	3,730	319	54,257	226
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	1,250	353	3,730	319	54,257	226
Veneer and plywood	Truck	--	--	--	--	--	--	--	--
	Rail	--	--	--	--	2,131	319	18,602	242
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	--	--	2,131	319	18,602	242
All types	Truck	--	--	--	--	--	--	--	--
	Rail	--	--	1,250	353	5,861	319	72,859	230
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	1,250	353	5,861	319	72,859	230
Total, west coast:									
Lumber	Truck	490,476	9	1,183,607	41	624,884	26	405,264	35
	Rail	226,391	98	826,652	179	404,328	104	147,696	119
	Barge	175,934	64	343,374	62	22,255	4	18,000	2
	Onsite	8,143	1	188,777	1	141,574	1	127,327	1
	Total	900,944	42	2,542,410	86	1,193,041	49	698,287	46
Veneer and plywood	Truck	102,580	25	273,581	57	296,905	25	210,445	24
	Rail	50,244	100	527,212	157	466,601	129	72,887	211
	Barge	28,800	46	27,000	54	--	--	--	--
	Onsite	--	--	45,736	1	77,097	1	37,756	1
	Total	181,624	49	873,529	115	840,603	81	321,088	64
All types	Truck	593,056	11	1,457,188	44	921,789	26	615,709	31
	Rail	276,635	99	1,353,864	171	870,929	118	220,583	150
	Barge	204,734	61	370,374	62	22,255	4	18,000	2
	Onsite	8,143	1	234,513	1	218,671	1	165,083	1
	Total	1,082,568	43	3,415,939	93	2,033,644	62	1,019,375	52

rigin, type of shipping mill, carrier, and area of destination, 1968–Continued

ination

Coastal alifornia		Eastern Washington		Eastern Oregon		Interior California		Total, all areas	
unt	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
ns	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
--	--	14,400	105	64,185	32	--	--	113,125	62
--	--	132,302	170	7,574	16	--	--	471,667	207
--	--	--	--	--	--	--	--	--	--
--	--	--	--	46,600	1	--	--	46,600	1
--	--	146,702	163	118,359	18	--	--	631,392	166
--	--	2,564	170	23,088	1	--	--	37,058	52
--	--	70,314	154	--	--	--	--	93,513	179
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	72,878	155	23,088	1	--	--	130,571	143
--	--	16,964	115	87,273	23	--	--	150,183	59
--	--	202,616	164	7,574	16	--	--	565,180	202
--	--	--	--	--	--	--	--	--	--
--	--	--	--	46,600	1	--	--	46,600	1
--	--	219,580	160	141,447	15	--	--	761,963	162
,504	99	--	--	--	--	147,775	31	260,279	59
,659	162	--	--	--	--	20,266	80	437,162	168
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	138,464	1	138,464	1
,163	147	--	--	--	--	306,505	21	835,905	107
,000	99	--	--	--	--	2,100	1	21,100	89
,016	124	--	--	--	--	933	59	66,682	162
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	44,015	1	44,015	1
,016	117	--	--	--	--	47,048	2	131,797	96
,504	99	--	--	--	--	149,875	30	281,379	62
,675	158	--	--	--	--	21,199	79	503,844	167
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	182,479	1	182,479	1
,179	144	--	--	--	--	353,553	18	967,702	105
,099	49	47,063	119	86,024	73	147,775	31	4,036,192	37
,628	151	272,991	163	7,574	16	20,266	80	2,325,526	146
--	--	--	--	--	--	--	--	559,563	58
,381	1	--	--	46,600	1	138,464	1	710,266	1
,108	75	320,054	156	140,198	46	306,505	21	7,631,547	68
,921	57	2,564	170	23,088	1	2,100	1	1,050,184	37
,656	118	82,314	164	--	--	15,141	300	1,264,055	148
,600	1	--	--	--	--	--	--	85,400	62
,800	1	--	--	--	--	44,015	1	227,404	1
,977	68	84,878	164	23,088	1	61,256	75	2,627,043	88
,020	50	49,627	121	109,112	58	149,875	30	5,086,376	37
,284	147	355,305	163	7,574	16	35,407	175	3,589,581	147
,600	86	--	--	--	--	--	--	644,963	59
,181	1	--	--	46,600	1	182,479	1	937,670	1
,085	74	404,932	158	163,286	40	367,761	30	10,258,590	73

Table 8.–Flows of residues to pulpmills by area of orig

(Continued through page 33)

Area of origin and type of shipping mill	Carrier	Area							
		Northwest Washington		Lower Columbia		West Central Oregon		Southwest Oregon	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Averag distar
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
Northwest Washington:									
Lumber	Truck	445,585	5	2,200	99	--	--	--	--
	Rail	145,647	48	2,000	109	--	--	--	--
	Barge	175,934	64	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	767,166	27	4,200	104	--	--	--	--
Veneer and plywood	Truck	68,956	2	--	--	--	--	--	--
	Rail	25,944	47	6,102	93	--	--	--	--
	Barge	28,800	46	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	123,700	21	6,102	93	--	--	--	--
All types	Truck	514,541	4	2,200	99	--	--	--	--
	Rail	171,591	48	8,102	97	--	--	--	--
	Barge	204,734	61	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	890,866	26	10,302	97	--	--	--	--
Lower Columbia:									
Lumber	Truck	32,677	46	942,469	34	19,110	52	--	--
	Rail	8,333	152	217,334	76	4,743	66	--	--
	Barge	--	--	336,374	61	--	--	--	--
	Onsite	--	--	188,777	1	--	--	--	--
	Total	41,010	68	1,684,954	41	23,853	55	--	--
Veneer and plywood	Truck	33,624	73	207,431	44	37,200	35	--	--
	Rail	--	--	117,628	72	3,648	23	--	--
	Barge	--	--	14,400	23	--	--	--	--
	Onsite	--	--	45,736	1	--	--	--	--
	Total	33,624	73	385,195	47	40,848	34	--	--
All types	Truck	66,301	60	1,149,900	36	56,310	41	--	--
	Rail	8,333	152	334,962	75	8,391	47	--	--
	Barge	--	--	350,774	60	--	--	--	--
	Onsite	--	--	234,513	1	--	--	--	--
	Total	74,634	70	2,070,149	42	64,701	42	--	--
West Central Oregon:									
Lumber	Truck	--	--	140,517	74	324,589	11	37,374	35
	Rail	--	--	194,562	151	145,898	31	77,040	42
	Barge	--	--	--	--	22,255	4	--	--
	Onsite	--	--	--	--	116,285	1	--	--
	Total	--	--	335,079	119	609,027	14	114,414	40
Veneer and plywood	Truck	--	--	33,880	155	240,091	20	--	--
	Rail	--	--	217,352	139	158,457	68	11,085	63
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	62,487	1	--	--
	Total	--	--	251,232	141	461,035	34	11,085	63
All types	Truck	--	--	174,397	89	564,680	15	37,374	35
	Rail	--	--	411,914	145	304,355	50	88,125	44
	Barge	--	--	--	--	22,255	4	--	--
	Onsite	--	--	--	--	178,772	1	--	--
	Total	--	--	586,311	128	1,070,062	22	125,499	42

e of shipping mill, carrier, and area of destination, 1968

tination

Coastal California		Eastern Washington		Eastern Oregon		Interior California		Total, all areas	
ount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
ons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
--	--	--	--	--	--	--	--	447,785	5
--	--	--	--	--	--	--	--	147,647	49
--	--	--	--	--	--	--	--	175,934	64
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	771,366	27
--	--	--	--	--	--	--	--	68,956	2
--	--	--	--	--	--	--	--	32,046	56
--	--	--	--	--	--	--	--	28,800	46
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	129,802	25
--	--	--	--	--	--	--	--	516,741	5
--	--	--	--	--	--	--	--	179,693	50
--	--	--	--	--	--	--	--	204,734	61
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	901,168	27
--	--	--	--	--	--	--	--	994,256	35
--	--	--	--	--	--	--	--	230,410	78
--	--	--	--	--	--	--	--	336,374	61
--	--	--	--	--	--	--	--	188,777	1
--	--	--	--	--	--	--	--	1,749,817	42
--	--	--	--	--	--	--	--	278,255	47
--	--	--	--	--	--	--	--	121,276	71
--	--	--	--	--	--	--	--	14,400	23
--	--	--	--	--	--	--	--	45,736	1
--	--	--	--	--	--	--	--	459,667	48
--	--	--	--	--	--	--	--	1,272,511	38
--	--	--	--	--	--	--	--	351,686	76
--	--	--	--	--	--	--	--	350,774	60
--	--	--	--	--	--	--	--	234,513	1
--	--	--	--	--	--	--	--	2,209,484	43
--	--	--	--	--	--	--	--	502,480	30
--	--	--	--	--	--	--	--	417,500	89
--	--	--	--	--	--	--	--	22,255	4
--	--	--	--	--	--	--	--	116,285	1
--	--	--	--	--	--	--	--	1,058,520	50
--	--	--	--	--	--	--	--	273,971	37
--	--	--	--	--	--	--	--	386,894	108
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	62,487	1
--	--	--	--	--	--	--	--	723,352	72
--	--	--	--	--	--	--	--	776,451	33
--	--	--	--	--	--	--	--	804,394	98
--	--	--	--	--	--	--	--	22,255	4
--	--	--	--	--	--	--	--	178,772	1
--	--	--	--	--	--	--	--	1,781,872	59

Table 8.–Flows of residues to pulpmills by area of origin, type

Area of origin and type of shipping mill	Carrier	Area							
		Northwest Washington		Lower Columbia		West Central Oregon		Southwest Oregon	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distar
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
Southwest Oregon:									
Lumber	Truck	--	--	--	--	39,412	130	96,322	27
	Rail	--	--	94,878	224	122,894	168	6,204	57
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	73,754	1
	Total	--	--	94,878	224	162,306	159	176,280	17
Veneer and plywood	Truck	--	--	--	--	7,008	71	--	--
	Rail	--	--	99,756	233	297,565	163	43,200	236
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	37,756	1
	Total	--	--	99,756	233	304,573	161	80,956	126
All types	Truck	--	--	--	--	46,420	121	96,322	27
	Rail	--	--	194,634	228	420,459	164	49,404	213
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	111,510	1
	Total	--	--	194,634	228	466,879	160	257,236	51
Coastal California:									
Lumber	Truck	--	--	--	--	--	--	--	--
	Rail	--	--	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	--	--	--	--	--	--
Veneer and plywood	Truck	--	--	--	--	--	--	--	--
	Rail	--	--	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	--	--	--	--	--	--
All types	Truck	--	--	--	--	--	--	--	--
	Rail	--	--	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	--	--	--	--	--	--
Eastern Washington:									
Lumber	Truck	--	--	--	--	--	--	--	--
	Rail	59,391	148	80,638	307	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	59,391	148	80,638	307	--	--	--	--
Veneer and plywood	Truck	--	--	--	--	--	--	--	--
	Rail	24,300	156	30,550	430	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	24,300	156	30,550	430	--	--	--	--
All types	Truck	--	--	--	--	--	--	--	--
	Rail	83,691	150	111,188	341	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	83,691	150	111,188	341	--	--	--	--

ping mill, carrier, and area of destination, 1968–Continued

ination

Coastal California		Eastern Washington		Eastern Oregon		Interior California		Total, all areas	
unt	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
ns	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
--	--	--	--	--	--	--	--	135,734	57
--	--	--	--	--	--	--	--	223,976	189
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	73,754	1
--	--	--	--	--	--	--	--	433,464	115
--		--	--	--	--	--	--	7,008	71
--		--	--	--	--	--	--	440,521	186
,600	86	--	--	--	--	--	--	29,600	86
--	--	--	--	--	--	--	--	37,756	1
,600	86	--	--	--	--	--	--	514,885	165
--	--	--	--	--	--	--	--	142,742	58
--	--	--	--	--	--	--	--	664,497	187
,600	86	--	--	--	--	--	--	29,600	86
--	--	--	--	--	--	--	--	111,510	1
,600	86	--	--	--	--	--	--	948,349	142
,653	47	--	--	--	--	--	--	694,653	47
,536	115	--	--	--	--	--	--	24,536	115
--	--	--	--	--	--	--	--	--	--
,381	1	--	--	--	--	--	--	59,381	1
,570	46	--	--	--	--	--	--	778,570	46
,921	50	--	--	--	--	--	--	119,921	50
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
,800	1	--	--	--	--	--	--	22,800	1
,721	42	--	--	--	--	--	--	142,721	42
,574	48	--	--	--	--	--	--	814,574	48
,536	115	--	--	--	--	--	--	24,536	115
--	--	--	--	--	--	--	--	--	--
,181	1	--	--	--	--	--	--	82,181	1
,291	45	--	--	--	--	--	--	921,291	45
--	--	32,663	125	--	--	--	--	32,663	125
--	--	140,689	157	--	--	--	--	280,718	198
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	173,352	151	--	--	--	--	313,381	190
--	--	--	--	--	--	--	--	--	--
--	--	12,000	222	--	--	--	--	66,850	293
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	12,000	222	--	--	--	--	66,850	293
--	--	32,663	125	--	--	--	--	32,663	125
--	--	152,689	162	--	--	--	--	347,568	216
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	185,352	155	--	--	--	--	380,231	208

Table 8.–Flows of residues to pulpmills by area of origin, typ

Area of origin and type of shipping mill	Carrier	Area							
		Northwest Washington		Lower Columbia		West Central Oregon		Southwest Oregon	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Avera dista
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Mil*
Eastern Oregon:									
Lumber	Truck	--	--	23,200	110	--	--	--	--
	Rail	13,020	405	235,990	236	82,781	173	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	13,020	405	259,190	224	82,781	173	--	--
Veneer and plywood	Truck	--	--	9,696	110	1,710	242	--	--
	Rail	--	--	23,199	253	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	32,895	211	1,710	242	--	--
All types	Truck	--	--	32,896	110	1,710	242	--	--
	Rail	13,020	405	259,189	237	82,781	173	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	13,020	405	292,085	223	84,491	174	--	--
Interior California:									
Lumber	Truck	--	--	--	--	--	--	--	--
	Rail	--	--	1,250	353	3,730	319	54,257	226
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	1,250	353	3,730	319	54,257	226
Veneer and plywood	Truck	--	--	--	--	--	--	--	--
	Rail	--	--	--	--	2,131	319	18,602	242
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	--	--	2,131	319	18,602	242
All types	Truck	--	--	--	--	--	--	--	--
	Rail	--	--	1,250	353	5,861	319	72,859	230
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	1,250	353	5,861	319	72,859	230
Total, west coast:									
Lumber	Truck	478,262	8	1,108,386	41	383,111	25	133,696	29
	Rail	226,391	98	826,652	179	360,046	114	137,501	115
	Barge	175,934	64	336,374	61	22,255	4	--	--
	Onsite	--	--	188,777	1	116,285	1	73,754	1
	Total	880,587	42	2,460,189	87	881,697	58	344,951	57
Veneer and plywood	Truck	102,580	25	251,007	62	286,009	25	--	--
	Rail	50,244	100	494,587	165	461,801	130	72,887	211
	Barge	28,800	46	14,400	23	--	--	--	--
	Onsite	--	--	45,736	1	62,487	1	37,756	1
	Total	181,624	49	805,730	121	810,297	83	110,643	139
All types	Truck	580,842	11	1,359,393	45	669,120	25	133,696	29
	Rail	276,635	99	1,321,239	174	821,847	123	210,388	148
	Barge	204,734	61	350,774	60	22,255	4	--	--
	Onsite	--	--	234,513	1	178,772	1	111,510	1
	Total	1,062,211	43	3,265,919	95	1,691,994	70	455,594	77

ng mill, carrier, and area of destination, 1968–Continued

nation

Coastal alifornia		Eastern Washington		Eastern Oregon		Interior California		Total, all areas	
unt	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
ns	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
--	--	14,400	105	--	--	--	--	37,600	108
--	--	132,302	170	--	--	--	--	464,093	210
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	146,702	163	--	--	--	--	501,693	203
--	--	2,564	170	--	--	--	--	13,970	137
--	--	70,314	154	--	--	--	--	93,513	179
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	72,878	155	--	--	--	--	107,483	173
--	--	16,964	115	--	--	--	--	51,570	116
--	--	202,616	164	--	--	--	--	557,606	205
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	219,580	160	--	--	--	--	609,176	197
,365	97	--	--	--	--	95,748	45	190,113	71
,659	162	--	--	--	--	20,266	80	437,162	168
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	48,600	1	48,600	1
,024	149	--	--	--	--	164,614	36	675,875	129
,000	99	--	--	--	--	2,100	1	21,100	89
,016	124	--	--	--	--	933	59	66,682	162
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
,016	117	--	--	--	--	3,033	18	87,782	145
,365	97	--	--	--	--	97,848	44	211,213	73
,675	158	--	--	--	--	21,199	79	503,844	167
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	48,600	1	48,600	1
,040	145	--	--	--	--	167,647	36	763,657	131
,018	53	47,063	119	--	--	95,748	45	3,035,284	38
,195	159	272,991	163	--	--	20,266	80	2,226,042	150
--	--	--	--	--	--	--	--	534,563	60
,381	1	--	--	--	--	48,600	1	486,797	1
,594	84	320,054	156	--	--	164,614	36	6,282,686	77
,921	57	2,564	170	--	--	2,100	1	783,181	43
,016	124	82,314	164	--	--	933	59	1,207,782	150
,600	86	--	--	--	--	--	--	72,800	58
,800	1	--	--	--	--	--	--	168,779	1
,337	68	84,878	164	--	--	3,033	18	2,232,542	98
,939	54	49,627	121	--	--	97,848	44	3,818,465	39
,211	156	355,305	163	--	--	21,199	79	3,433,824	150
,600	86	--	--	--	--	--	--	607,363	59
,181	1	--	--	--	--	48,600	1	655,576	1
,931	81	404,932	158	--	--	167,647	36	8,515,228	82

Table 9 -Flows of residues to board mills by area of or

(Continued through page 39)

Area of origin and type of shipping mill	Carrier	Area							
		Northwest Washington		Lower Columbia		West Central Oregon		Southwest Oregon	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Avera dista
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Mile*
Northwest Washington:									
Lumber	Truck	12,214	1	--	--	--	--	--	--
	Rail	--	--	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	8,143	1	--	--	--	--	--	--
	Total	20,357	1	--	--	--	--	--	--
Veneer and plywood	Truck	--	--	--	--	--	--	--	--
	Rail	--	--	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	--	--	--	--	--	--
All types	Truck	12,214	1	--	--	--	--	--	--
	Rail	--	--	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	8,143	1	--	--	--	--	--	--
	Total	20,357	1	--	--	--	--	--	--
Lower Columbia:									
Lumber	Truck	--	--	67,541	36	70,821	42	21,440	199
	Rail	--	--	--	--	9,120	23	7,517	214
	Barge	--	--	7,000	88	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	74,541	41	79,941	40	28,957	20
Veneer and plywood	Truck	--	--	22,574	1	8,376	21	--	--
	Rail	--	--	32,625	38	--	--	--	--
	Barge	--	--	12,600	88	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	67,799	34	8,376	21	--	--
All types	Truck	--	--	90,115	27	79,197	40	21,440	199
	Rail	--	--	32,625	38	9,120	23	7,517	214
	Barge	--	--	19,600	88	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	142,340	38	88,317	38	28,957	20
West Central Oregon:									
Lumber	Truck	--	--	7,680	49	170,952	20	15,179	5
	Rail	--	--	--	--	35,162	21	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	25,289	1	--	--
	Total	--	--	7,680	49	231,403	18	15,179	5
Veneer and plywood	Truck	--	--	--	--	2,520	28	--	--
	Rail	--	--	--	--	4,800	45	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	14,610	1	--	--
	Total	--	--	--	--	21,930	13	--	--
All types	Truck	--	--	7,680	49	173,472	20	15,179	5
	Rail	--	--	--	--	39,962	23	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	39,899	1	--	--
	Total	--	--	7,680	49	253,333	17	15,179	5

of shipping mill, carrier, and area of destination, 1968

nation

oastal lifornia		Eastern Washington		Eastern Oregon		Interior California		Total, all areas	
nt	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
s	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
--	--	--	--	--	--	--	--	12,214	1
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	8,143	1
--	--	--	--	--	--	--	--	20,357	1
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	12,214	1
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	8,143	1
--	--	--	--	--	--	--	--	20,357	1
--	--	--	--	--	--	--	--	159,802	61
--	--	--	--	--	--	--	--	16,637	109
--	--	--	--	--	--	--	--	7,000	88
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	183,439	66
--	--	--	--	--	--	--	--	30,950	6
--	--	--	--	--	--	--	--	32,625	38
--	--	--	--	--	--	--	--	12,600	88
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	76,175	33
--	--	--	--	--	--	--	--	190,752	52
--	--	--	--	--	--	--	--	49,262	62
--	--	--	--	--	--	--	--	19,600	88
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	259,614	56
--	--	--	--	--	--	--	--	193,811	24
--	--	--	--	--	--	--	--	35,162	21
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	25,289	1
--	--	--	--	--	--	--	--	254,262	21
--	--	--	--	--	--	--	--	2,520	28
--	--	--	--	--	--	--	--	4,800	45
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	14,610	1
--	--	--	--	--	--	--	--	21,930	13
--	--	--	--	--	--	--	--	196,331	24
--	--	--	--	--	--	--	--	39,962	23
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	39,899	1
--	--	--	--	--	--	--	--	276,192	20

Table 9 -Flows of residues to board mills by area of origin, 1

(Continued through page 39)

Area of origin and type of shipping mill	Carrier	Northwest Washington		Lower Columbia		West Central Oregon		Southwest Oregon	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Aver dist
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Mi*
Southwest Oregon:									
Lumber	Truck	--	--	--	--	--	--	223,609	1
	Rail	--	--	--	--	--	--	2,678	4
	Barge	--	--	--	--	--	--	18,000	
	Onsite	--	--	--	--	--	--	53,573	
	Total	--	--	--	--	--	--	297,860	1
Veneer and plywood	Truck	--	--	--	--	--	--	207,160	2
	Rail	--	--	--	--	--	--	--	-
	Barge	--	--	--	--	--	--	--	-
	Onsite	--	--	--	--	--	--	--	-
	Total	--	--	--	--	--	--	207,160	2
All types	Truck	--	--	--	--	--	--	430,769	2
	Rail	--	--	--	--	--	--	2,678	4
	Barge	--	--	--	--	--	--	18,000	
	Onsite	--	--	--	--	--	--	53,573	
	Total	--	--	--	--	--	--	505,020	1
Coastal California:									
Lumber	Truck	--	--	--	--	--	--	--	-
	Rail	--	--	--	--	--	--	--	-
	Barge	--	--	--	--	--	--	--	-
	Onsite	--	--	--	--	--	--	--	-
	Total	--	--	--	--	--	--	--	-
Veneer and plywood	Truck	--	--	--	--	--	--	3,285	1
	Rail	--	--	--	--	--	--	--	-
	Barge	--	--	--	--	--	--	--	-
	Onsite	--	--	--	--	--	--	--	-
	Total	--	--	--	--	--	--	3,285	1
All types	Truck	--	--	--	--	--	--	3,285	1
	Rail	--	--	--	--	--	--	--	-
	Barge	--	--	--	--	--	--	--	-
	Onsite	--	--	--	--	--	--	--	-
	Total	--	--	--	--	--	--	3,285	1
Eastern Washington:									
Lumber	Truck	--	--	--	--	--	--	--	-
	Rail	--	--	--	--	--	--	--	-
	Barge	--	--	--	--	--	--	--	-
	Onsite	--	--	--	--	--	--	--	-
	Total	--	--	--	--	--	--	--	-
Veneer and plywood	Truck	--	--	--	--	--	--	--	-
	Rail	--	--	--	--	--	--	--	-
	Barge	--	--	--	--	--	--	--	-
	Onsite	--	--	--	--	--	--	--	-
	Total	--	--	--	--	--	--	--	-
All types	Truck	--	--	--	--	--	--	--	-
	Rail	--	--	--	--	--	--	--	-
	Barge	--	--	--	--	--	--	--	-
	Onsite	--	--	--	--	--	--	--	-
	Total	--	--	--	--	--	--	--	-

g mill, carrier, and area of destination, 1968–Continued

ination

Coastal alifornia		Eastern Washington		Eastern Oregon		Interior California		Total, all areas	
unt	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
ns	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
3 280	31	--	--	--	--	--	--	258,889	20
--	--	--	--	--	--	--	--	2,678	48
--	--	--	--	--	--	--	--	18,000	2
--	--	--	--	--	--	--	--	53,573	1
3 280	31	--	--	--	--	--	--	333,140	16
--	--	--	--	--	--	--	--	207,160	22
--	--	--	--	--	--	14,208	316	14,208	316
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	14,208	316	221,368	41
3 280	31	--	--	--	--	--	--	466,049	21
--	--	--	--	--	--	14,208	316	16,886	273
--	--	--	--	--	--	--	--	18,000	2
--	--	--	--	--	--	--	--	53,573	1
3 280	31	--	--	--	--	14,208	316	554,508	26
0 662	29	--	--	--	--	--	--	208,662	29
3 433	59	--	--	--	--	--	--	37,433	59
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
6 095	33	--	--	--	--	--	--	246,095	33
--	--	--	--	--	--	--	--	3,285	141
640	59	--	--	--	--	--	--	4,640	59
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
640	59	--	--	--	--	--	--	7,925	92
0 662	29	--	--	--	--	--	--	211,947	31
4 073	59	--	--	--	--	--	--	42,073	59
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
5 735	34	--	--	--	--	--	--	254,020	35
--	--	--	--	21,839	195	--	--	21,839	195
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	21,839	195	--	--	21,839	195
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	21,839	195	--	--	21,839	195
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	21,839	195	--	--	21,839	195

Table 9.–Flows of residues to board mills by area of origin, typ

Area of origin and type of shipping mill	Carrier	Are							
		Northwest Washington		Lower Columbia		West Central Oregon		Southwest Oregon	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Aver dist
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Mil*
Eastern Oregon:									
Lumber	Truck	--	--	--	--	--	--	11,340	81
	Rail	--	--	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	--	--	--	--	11,340	81
Veneer and plywood	Truck	--	--	--	--	--	--	--	--
	Rail	--	--	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	--	--	--	--	--	--
All types	Truck	--	--	--	--	--	--	11,340	81
	Rail	--	--	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	--	--	--	--	11,340	81
Interior California:									
Lumber	Truck	--	--	--	--	--	--	--	--
	Rail	--	--	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	--	--	--	--	--	--
Veneer and plywood	Truck	--	--	--	--	--	--	--	--
	Rail	--	--	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	--	--	--	--	--	--
All types	Truck	--	--	--	--	--	--	--	--
	Rail	--	--	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--
	Total	--	--	--	--	--	--	--	--
Total, west coast:									
Lumber	Truck	12,214	1	75,221	37	241,773	26	271,568	37
	Rail	--	--	--	--	44,282	21	10,195	170
	Barge	--	--	7,000	88	--	--	18,000	2
	Onsite	8,143	1	--	--	25,289	1	53,573	1
	Total	20,357	1	82,221	41	311,344	23	353,336	33
Veneer and plywood	Truck	--	--	22,574	1	10,896	22	210,445	24
	Rail	--	--	32,625	38	4,800	45	--	--
	Barge	--	--	12,600	88	--	--	--	--
	Onsite	--	--	--	--	14,610	1	--	--
	Total	--	--	67,799	34	30,306	15	210,445	24
All types	Truck	12,214	1	97,795	29	252,669	26	482,013	31
	Rail	--	--	32,625	38	49,082	23	10,195	170
	Barge	--	--	19,600	88	--	--	18,000	2
	Onsite	8,143	1	--	--	39,899	1	53,573	1
	Total	20,357	1	150,020	38	341,650	23	563,781	30

g mill, carrier, and area of destination, 1968–Continued

uation									
astal ifornia		Eastern Washington		Eastern Oregon		Interior California		Total, all areas	
t	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
	Miles	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
--	--	--	--	64,185	32	--	--	75,525	39
--	--	--	--	7,574	16	--	--	7,574	16
--	--	--	--	--	--	--	--	--	--
--	--	--	--	46,600	1	--	--	46,600	1
--	--	--	--	118,359	18	--	--	129,699	24
--	--	--	--	23,088	1	--	--	23,088	1
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	23,088	1	--	--	23,088	1
--	--	--	--	87,273	23	--	--	98,613	30
--	--	--	--	7,574	16	--	--	7,574	16
--	--	--	--	--	--	--	--	--	--
--	--	--	--	46,600	1	--	--	46,600	1
--	--	--	--	141,447	15	--	--	152,787	20
39	104	--	--	--	--	52,027	3	70,166	29
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	89,864	1	89,864	1
39	104	--	--	--	--	141,891	1	160,030	13
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	44,015	1	44,015	1
--	--	--	--	--	--	44,015	1	44,015	1
39	104	--	--	--	--	52,027	3	70,166	29
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	133,879	1	133,879	1
39	104	--	--	--	--	185,906	1	204,045	10
81	34	--	--	86,024	73	52,027	3	1,000,908	35
33	59	--	--	7,574	16	--	--	99,484	50
--	--	--	--	--	--	--	--	25,000	26
--	--	--	--	46,600	1	89,864	1	223,469	1
14	37	--	--	140,198	46	141,891	1	1,348,861	30
--	--	--	--	23,088	1	--	--	267,003	20
40	59	--	--	--	--	14,208	316	56,273	110
--	--	--	--	--	--	--	--	12,600	88
--	--	--	--	--	--	44,015	1	58,625	1
40	59	--	--	23,088	1	58,223	77	394,501	32
81	34	--	--	109,112	58	52,027	3	1,267,911	31
73	59	--	--	7,574	16	14,208	316	155,757	72
--	--	--	--	--	--	--	--	37,600	46
--	--	--	--	46,600	1	133,879	1	282,094	1
54	38	--	--	163,286	40	200,114	23	1,743,362	30

Table 10.—Amount and average distance of shipment of residues to pulp and board mills by area of origin, type of shipping mill, carrier, and ownership of pulp and board mills, 1968

(Continued through page 43)

Area of origin and type of shipping mill	Carrier	Ownership of pulpmill						Ownership of board mill					
		Same as shipping mill		Different from shipping mill		Total, all types		Same as shipping mill		Different from shipping mill		Total, all types	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
Northwest Washington:													
Lumber	Truck	222,975	1	224,810	10	447,785	5	12,214	1	--	--	12,214	1
	Rail	100,628	39	47,019	71	147,647	49	--	--	--	--	--	--
	Barge	--	--	175,934	64	175,934	64	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	8,143	1	--	--	8,143	1
	Total	323,603	12	447,763	38	771,366	27	20,357	1	--	--	20,357	1
Veneer and plywood	Truck	--	--	68,956	2	68,956	2	--	--	--	--	--	--
	Rail	22,444	46	9,602	81	32,046	56	--	--	--	--	--	--
	Barge	10,800	55	18,000	41	28,800	46	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--	--	--	--	--
	Total	33,244	49	96,558	17	129,802	25	--	--	--	--	--	--
All types	Truck	222,975	1	293,766	8	516,741	5	12,214	1	--	--	12,214	1
	Rail	123,072	40	56,621	72	179,693	50	--	--	--	--	--	--
	Barge	10,800	55	193,934	62	204,734	61	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	8,143	1	--	--	8,143	1
	Total	356,847	16	544,321	34	901,168	27	20,357	1	--	--	20,357	1
Lower Columbia:													
Lumber	Truck	63,428	21	930,828	36	994,256	35	6,480	38	153,322	61	159,802	61
	Rail	93,043	85	137,367	74	230,410	78	--	--	16,637	109	16,637	109
	Barge	60,000	37	276,374	66	336,374	61	--	--	7,000	88	7,000	88
	Onsite	153,785	1	34,992	1	188,777	1	--	--	--	--	--	--
	Total	370,256	31	1,379,561	45	1,749,817	42	6,480	38	176,959	67	183,439	66
Veneer and plywood	Truck	--	--	278,255	47	278,255	47	22,574	1	8,376	21	30,950	6
	Rail	3,648	23	117,628	72	121,276	71	32,625	38	--	--	32,625	38
	Barge	2,400	43	12,000	19	14,400	23	--	--	12,600	88	12,600	88
	Onsite	45,736	1	--	--	45,736	1	--	--	--	--	--	--
	Total	51,784	4	407,883	53	459,667	48	55,199	22	20,976	61	76,175	33
All types	Truck	63,428	21	1,209,083	38	1,272,511	38	29,054	9	161,698	59	190,752	52
	Rail	96,691	83	254,995	73	351,686	76	32,625	38	16,637	109	49,262	62
	Barge	62,400	37	288,374	64	350,774	60	--	--	19,600	88	19,600	88

	Rail	29,362	61	388,136	91	417,500	89	25,600	19	9,362	28	35,162	21
	Barge	--	--	22,255	4	22,255	4	--	--	--	--	--	--
	Onsite	116,285	1	--	--	116,285	1	25,289	1	--	--	25,289	1
	Total	145,647	13	912,873	56	1,058,520	50	50,889	10	203,373	24	254,262	21
Veneer and plywood	Truck	79,123	13	194,848	46	273,971	37	--	--	2,520	28	2,520	28
	Rail	81,536	70	305,358	118	386,894	108	--	--	4,800	45	4,800	45
	Barge	--	--	--	--	--	--	--	--	--	--	--	--
	Onsite	62,487	1	--	--	62,487	1	14,610	1	--	--	14,610	1
	Total	223,146	30	500,206	90	723,352	72	14,610	1	7,320	39	21,930	13
All types	Truck	79,123	13	697,328	35	776,451	33	--	--	196,331	24	196,331	24
	Rail	110,898	68	693,496	103	804,394	98	25,600	19	14,362	32	39,962	23
	Barge	--	--	22,255	4	22,255	4	--	--	--	--	--	--
	Onsite	178,772	1	--	--	178,772	1	39,899	1	--	--	39,899	1
	Total	368,793	23	1,413,079	68	1,781,872	59	65,499	8	210,693	24	276,192	20
Southwest Oregon:													
Lumber	Truck	--	--	135,734	57	135,734	57	--	--	258,889	20	258,889	20
	Rail	--	--	223,976	189	223,976	189	--	--	2,678	48	2,678	48
	Barge	--	--	--	--	--	--	--	--	18,000	2	18,000	2
	Onsite	73,754	1	--	--	73,754	1	--	--	53,573	1	53,573	1
	Total	73,754	1	359,710	139	433,464	115	--	--	333,140	16	333,140	16
Veneer and plywood	Truck	--	--	7,008	71	7,008	71	182,248	23	24,912	17	207,160	22
	Rail	47,112	212	393,409	183	440,521	186	14,208	316	--	--	14,208	316
	Barge	--	--	29,600	86	29,600	86	--	--	--	--	--	--
	Onsite	37,756	1	--	--	37,756	1	--	--	--	--	--	--
	Total	84,868	118	430,017	174	514,885	165	196,456	44	24,912	17	221,368	41
All types	Truck	--	--	142,742	58	142,742	58	182,248	23	283,801	19	466,049	21
	Rail	47,112	212	617,385	185	664,497	187	14,208	316	2,678	48	16,886	273
	Barge	--	--	29,600	86	29,600	86	--	--	18,000	2	18,000	2
	Onsite	111,510	1	--	--	111,510	1	--	--	53,573	1	53,573	1
	Total	158,622	63	789,727	158	948,349	142	196,456	44	358,052	16	554,508	26
Coastal California:													
Lumber	Truck	115,642	58	579,011	45	694,653	47	29,600	6	179,062	33	208,662	29
	Rail	--	--	24,536	115	24,536	115	--	--	37,433	59	37,433	59
	Barge	--	--	--	--	--	--	--	--	--	--	--	--
	Onsite	59,381	1	--	--	59,381	1	--	--	--	--	--	--
	Total	175,023	38	603,547	48	778,570	46	29,600	6	216,495	37	246,095	33
Veneer and plywood	Truck	28,116	22	91,805	59	119,921	50	3,285	141	--	--	3,285	141
	Rail	--	--	--	--	--	--	--	--	4,640	59	4,640	59
	Barge	--	--	--	--	--	--	--	--	--	--	--	--
	Onsite	22,800	1	--	--	22,800	1	--	--	--	--	--	--
	Total	50,916	12	91,805	59	142,721	42	3,285	141	4,640	59	7,925	92
All types	Truck	143,758	51	670,816	47	814,574	48	32,885	19	179,062	33	211,947	31
	Rail	--	--	24,536	115	24,536	115	--	--	42,073	59	42,073	59
	Barge	--	--	--	--	--	--	--	--	--	--	--	--
	Onsite	82,181	1	--	--	82,181	1	--	--	--	--	--	--
	Total	225,939	33	695,352	49	921,291	45	32,885	19	221,135	38	254,020	35

Table 10.—Amount and average distance of shipment of residues to pulp and board mills by area of origin, type of shipping mill, carrier, and ownership of pulp and board mills, 1968—Continued

Area of origin and type of shipping mill	Carrier	Ownership of pulpmill						Ownership of board mill					
		Same as shipping mill		Different from shipping mill		Total, all types		Same as shipping mill		Different from shipping mill		Total, all types	
		Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance	Amount	Average distance
		Tons	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*	*Tons*	*Miles*
Eastern Washington:													
Lumber	Truck	--	--	32,663	125	32,663	125	21,839	195	--	--	21,839	195
	Rail	85,890	141	194,828	223	280,718	198	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--	--	--	--	--
	Total	85,890	141	227,491	209	313,381	190	21,839	195	--	--	21,839	195
Veneer and plywood	Truck	--	--	--	--	--	--	--	--	--	--	--	--
	Rail	30,550	430	36,300	177	66,850	293	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--	--	--	--	--
	Total	30,550	430	36,300	177	66,850	293	--	--	--	--	--	--
All types	Truck	--	--	32,663	125	32,663	125	21,839	195	--	--	21,839	195
	Rail	116,440	217	231,128	216	347,568	216	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--	--	--	--	--
	Total	116,440	217	263,791	205	380,231	208	21,839	195	--	--	21,839	195
Eastern Oregon:													
Lumber	Truck	--	--	37,600	108	37,600	108	--	--	75,525	39	75,525	39
	Rail	109,193	151	354,900	229	464,093	210	7,574	16	--	--	7,574	16
	Barge	--	--	--	--	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--	46,600	1	46,600	1
	Total	109,193	151	392,500	217	501,693	203	7,574	16	122,125	24	129,699	24
Veneer and plywood	Truck	--	--	13,970	137	13,970	137	--	--	23,088	1	23,088	1
	Rail	32,000	85	61,513	228	93,513	179	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--	--	--	--	--
	Total	32,000	85	75,483	211	107,483	173	--	--	23,088	1	23,088	1
All types	Truck	--	--	51,570	116	51,570	116	--	--	98,613	30	98,613	30
	Rail	141,193	136	416,413	228	557,606	205	7,574	16	--	--	7,574	16
	Barge	--	--	--	--	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	--	--	46,600	1	46,600	1
	Total	141,193	136	467,983	225	609,176	195	7,574	16	144,713	23	152,287	23
Western Oregon:													
Lumber	Truck	--	--	48,600	1	48,600	1	89,864	1	--	--	89,864	1

	Barge	--	--	--	--	--	--	--	--	--	--	--	--
	Onsite	48,600	1	--	--	48,600	1	89,864	1	--	--	89,864	1
	Total	140,744	107	535,131	134	675,875	129	130,502	1	29,528	68	160,030	13
Veneer and plywood	Truck	2,100	1	19,000	99	21,100	89	--	--	--	--	--	--
	Rail	40,958	205	25,724	94	66,682	162	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--	--	--	--	--
	Onsite	--	--	--	--	--	--	44,015	1	--	--	44,015	1
	Total	43,058	195	44,724	96	87,782	145	44,015	1	--	--	44,015	1
All types	Truck	20,006	42	191,207	76	211,213	73	40,638	1	29,528	68	70,166	29
	Rail	115,196	197	388,648	159	503,844	167	--	--	--	--	--	--
	Barge	--	--	--	--	--	--	--	--	--	--	--	--
	Onsite	48,600	1	--	--	48,600	1	133,879	1	--	--	133,879	1
	Total	183,802	128	579,855	131	763,657	131	174,517	1	29,528	68	204,045	10
Total, west coast:													
Lumber	Truck	419,951	21	2,615,333	40	3,035,284	38	110,771	42	890,137	34	1,000,908	35
	Rail	492,354	115	1,733,688	160	2,226,042	150	33,174	18	66,310	66	99,484	50
	Barge	60,000	37	474,563	62	534,563	60	--	--	25,000	26	25,000	26
	Onsite	451,805	1	34,992	1	486,797	1	123,296	1	100,173	1	223,469	1
	Total	1,424,110	48	4,858,576	85	6,282,686	77	267,241	20	1,081,620	32	1,348,861	30
Veneer and plywood	Truck	109,339	15	673,842	47	783,181	43	208,107	22	58,896	12	267,003	20
	Rail	258,248	159	949,534	147	1,207,782	150	46,833	122	9,440	51	56,273	110
	Barge	13,200	53	59,600	59	72,800	58	--	--	12,600	88	12,600	88
	Onsite	168,779	1	--	--	168,779	1	58,625	1	--	--	58,625	1
	Total	549,566	79	1,682,976	104	2,232,542	98	313,565	33	80,936	28	394,501	32
All types	Truck	529,290	20	3,289,175	42	3,818,465	39	318,878	29	949,033	32	1,267,911	31
	Rail	750,602	130	2,683,222	156	3,433,824	150	80,007	79	75,750	64	155,757	72
	Barge	73,200	40	534,163	62	607,363	59	--	--	37,600	46	37,600	46
	Onsite	620,584	1	34,992	1	655,576	1	181,921	1	100,173	1	282,094	1
	Total	1,973,676	56	6,541,552	90	8,515,228	82	580,806	27	1,162,556	32	1,743,362	30

Table 11.—Amount and average distance of shipment of residues from sawmills to pulp and board mills by area of origin, sawmill-size class, and carrier, 1968

(Continued through page 48)

Area of origin and sawmill-size class[1/]	Carrier	To pulpmills		To board mills	
		Amount	Average distance	Amount	Average distance
		Tons	*Miles*	*Tons*	*Miles*
Northwest Washington:					
D	Truck	28,175	42	--	--
	Rail	2,000	109	--	--
	Barge	5,488	27	--	--
	Onsite	--	--	--	--
	Total	35,663	44	--	--
C	Truck	54,923	5	--	--
	Rail	17,603	48	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	72,526	15	--	--
B	Truck	70,590	9	--	--
	Rail	10,916	141	--	--
	Barge	59,200	53	--	--
	Onsite	--	--	--	--
	Total	140,706	38	--	--
A	Truck	294,097	1	12,214	1
	Rail	117,128	39	--	--
	Barge	111,246	71	--	--
	Onsite	--	--	8,143	1
	Total	522,471	25	20,357	1
All size classes	Truck	447,785	5	12,214	1
	Rail	147,647	49	--	--
	Barge	175,934	64	--	--
	Onsite	--	--	8,143	1
	Total	771,366	27	20,357	1
Lower Columbia:					
D	Truck	93,077	30	6,000	81
	Rail	--	--	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	93,077	30	6,000	81
C	Truck	172,148	43	24,006	79
	Rail	72,811	93	--	--
	Barge	19,080	66	--	--
	Onsite	--	--	--	--
	Total	264,039	58	24,006	79
B	Truck	251,544	44	25,978	31
	Rail	10,200	67	--	--
	Barge	175,458	79	--	--
	Onsite	--	--	--	--
	Total	437,202	59	25,978	31
A	Truck	477,487	28	103,818	62
	Rail	147,399	72	16,637	109
	Barge	141,836	38	7,000	88
	Onsite	188,777	1	--	--
	Total	955,499	31	127,455	70
All size classes	Truck	994,256	35	159,802	61
	Rail	230,410	78	16,637	109
	Barge	336,374	61	7,000	88
	Onsite	188,777	1	--	--
	Total	1,749,817	42	183,439	66

[1/] See footnote at end of table.

Table 11.—Amount and average distance of shipment of residues from sawmills to pulp and board mills by area of origin, sawmill-size class, and carrier, 1968—Continued

Area of origin and sawmill-size class[1/]	Carrier	To pulpmills		To board mills	
		Amount	Average distance	Amount	Average distance
		Tons	*Miles*	*Tons*	*Miles*
West Central Oregon:					
D	Truck	33,602	56	3,936	7
	Rail	5,757	148	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	39,359	70	3,936	7
C	Truck	199,463	23	56,013	22
	Rail	28,376	87	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	227,839	31	56,013	22
B	Truck	122,372	30	91,223	22
	Rail	179,126	73	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	301,498	55	91,223	22
A	Truck	147,043	35	42,639	30
	Rail	204,241	102	35,162	21
	Barge	22,255	4	--	--
	Onsite	116,285	1	25,289	1
	Total	489,824	53	103,090	19
All size classes	Truck	502,480	30	193,811	24
	Rail	417,500	89	35,162	21
	Barge	22,255	4	--	--
	Onsite	116,285	1	25,289	1
	Total	1,058,520	50	254,262	21
Southwest Oregon:					
D	Truck	3,864	26	--	--
	Rail	--	--	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	3,864	26	--	--
C	Truck	--	--	52,464	11
	Rail	18,444	137	2,678	48
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	18,444	137	55,142	13
B	Truck	94,592	56	84,687	13
	Rail	106,700	189	--	--
	Barge	--	--	--	--
	Onsite	30,629	1	--	--
	Total	231,921	110	84,687	13
A	Truck	37,278	63	121,738	28
	Rail	98,832	198	--	--
	Barge	--	--	18,000	2
	Onsite	43,125	1	53,573	1
	Total	179,235	122	193,311	18
All size classes	Truck	135,734	57	258,889	20
	Rail	223,976	189	2,678	48
	Barge	--	--	18,000	2
	Onsite	73,754	1	53,573	1
	Total	433,464	115	333,140	16

[1/] See footnote at end of table.

Table 11.—Amount and average distance of shipment of residues from sawmills to pulp and board mills by area of origin, sawmill-size class, and carrier, 1968—Continued

Area of origin and sawmill-size class[1/]	Carrier	To pulpmills		To board mills	
		Amount	Average distance	Amount	Average distance
		Tons	*Miles*	*Tons*	*Miles*
Coastal California:					
D	Truck	--	--	3,600	77
	Rail	--	--	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	--	--	3,600	77
C	Truck	95,318	74	33,759	15
	Rail	--	--	--	--
	Barge	--	--	--	--
	Onsite	11,170	1	--	--
	Total	106,488	66	33,759	15
B	Truck	341,435	40	88,235	34
	Rail	20,209	100	12,992	59
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	361,644	43	101,227	37
A	Truck	257,900	47	83,068	28
	Rail	4,327	190	24,441	59
	Barge	--	--	--	--
	Onsite	48,211	1	--	--
	Total	310,438	42	107,509	35
All size classes	Truck	694,653	47	208,662	29
	Rail	24,536	115	37,433	59
	Barge	--	--	--	--
	Onsite	59,381	1	--	--
	Total	778,570	46	246,095	33
Eastern Washington:					
D	Truck	2,955	146	--	--
	Rail	6,030	299	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	8,985	248	--	--
C	Truck	13,196	241	--	--
	Rail	99,122	276	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	112,318	272	--	--
B	Truck	16,512	28	--	--
	Rail	72,444	173	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	88,956	146	--	--
A	Truck	--	--	21,839	195
	Rail	103,122	135	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	103,122	135	21,839	195
All size classes	Truck	32,663	125	21,839	195
	Rail	280,718	198	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	313,381	190	21,839	195

[1/] See footnote at end of table.

Table 11.—Amount and average distance of shipment of residues from sawmills to pulp and board mills by area of origin, sawmill-size class, and carrier, 1968—Continued

Area of origin and sawmill-size class[1/]	Carrier	To pulpmills		To board mills	
		Amount	Average distance	Amount	Average distance
		Tons	*Miles*	*Tons*	*Miles*
Eastern Oregon:					
D	Truck	--	--	--	--
	Rail	3,024	256	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	3,024	256	--	--
C	Truck	14,400	105	60,325	32
	Rail	146,929	213	7,574	16
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	161,329	204	67,899	31
B	Truck	23,200	110	15,200	66
	Rail	51,733	178	--	--
	Barge	--	--	--	--
	Onsite	--	--	22,600	1
	Total	74,933	157	37,800	27
A	Truck	--	--	--	--
	Rail	262,407	214	--	--
	Barge	--	--	--	--
	Onsite	--	--	24,000	1
	Total	262,407	214	24,000	1
All size classes	Truck	37,600	108	75,525	39
	Rail	464,093	210	7,574	16
	Barge	--	--	--	--
	Onsite	--	--	46,600	1
	Total	501,693	203	129,699	24
Interior California:					
D	Truck	5,000	141	--	--
	Rail	--	--	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	5,000	141	--	--
C	Truck	20,654	27	40,638	1
	Rail	89,495	135	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	110,149	114	40,638	1
B	Truck	128,346	68	24,568	72
	Rail	226,128	164	--	--
	Barge	--	--	--	--
	Onsite	--	--	--	--
	Total	354,474	129	24,568	72
A	Truck	36,113	95	4,960	47
	Rail	121,539	201	--	--
	Barge	--	--	--	--
	Onsite	48,600	1	89,864	1
	Total	206,252	135	94,824	3
All size classes	Truck	190,113	71	70,166	29
	Rail	437,162	168	--	--
	Barge	--	--	--	--
	Onsite	48,600	1	89,864	1
	Total	675,875	129	160,030	13

[1/] See footnote at end of table.

Table 11.—Amount and average distance of shipment of residues from sawmills to pulp and board mills by area of origin, sawmill-size class, and carrier, 1968—Continued

Area of origin and sawmill-size class[1/]	Carrier	To pulpmills		To board mills	
		Amount	Average distance	Amount	Average distance
		Tons	*Miles*	*Tons*	*Miles*
Total, west coast:					
D	Truck	166,673	43	13,536	59
	Rail	16,811	217	--	--
	Barge	5,488	27	--	--
	Onsite	--	--	--	--
	Total	188,972	58	13,536	59
C	Truck	570,102	43	267,205	23
	Rail	472,780	176	10,252	24
	Barge	19,080	66	--	--
	Onsite	11,170	1	--	--
	Total	1,073,132	102	277,457	23
B	Truck	1,048,591	44	329,891	29
	Rail	677,456	142	12,992	59
	Barge	234,658	73	--	--
	Onsite	30,629	1	22,600	1
	Total	1,991,334	80	365,483	29
A	Truck	1,249,918	29	390,276	46
	Rail	1,058,995	143	76,240	52
	Barge	275,337	49	25,000	26
	Onsite	444,998	1	200,869	1
	Total	3,029,248	66	692,385	33
All size classes	Truck	3,035,284	38	1,000,908	35
	Rail	2,226,042	150	99,484	50
	Barge	534,563	60	25,000	26
	Onsite	486,797	1	223,469	1
	Total	6,282,686	77	1,348,861	30

[1/] Mill-size classes identified as follows: Class A mills = 120,000+ board-foot capacity per 8-hour shift; B = 80,000-119,000; C = 40,000-79,000; D = less than 40,000.

Table 12.—Wood residues unused or used for fuel by type of residue, area, and industry, 1968

(Tons)

Area and industry	Type of residue			
	Coarse[1/]	Medium[2/]	Fine[3/]	Total
Northwest Washington:				
Lumber	108,571	241,758	423,084	773,413
Veneer and plywood	263,728	--	24,936	288,664
Total	372,299	241,758	448,020	1,062,077
Lower Columbia:				
Lumber	240,134	287,196	474,534	1,001,864
Veneer and plywood	188,961	--	25,056	214,017
Total	429,095	287,196	499,590	1,215,881
West Central Oregon:				
Lumber	89,057	249,746	420,948	759,751
Veneer and plywood	417,964	--	46,190	464,154
Total	507,021	249,746	467,138	1,223,905
Southwest Oregon:				
Lumber	189,509	86,594	487,358	763,461
Veneer and plywood	318,084	--	53,121	371,205
Total	507,593	86,594	540,479	1,134,666
Coastal California:				
Lumber	484,605	172,170	502,033	1,158,808
Veneer and plywood	118,872	--	11,082	129,954
Total	603,477	172,170	513,115	1,288,762
Eastern Washington:				
Lumber	103,632	120,244	189,661	413,537
Veneer and plywood	11,500	--	2,760	14,260
Total	115,132	120,244	192,421	427,797
Eastern Oregon:				
Lumber	245,903	128,533	423,982	798,418
Veneer and plywood	46,318	--	3,265	49,583
Total	292,221	128,533	427,247	848,001
Interior California:				
Lumber	746,226	406,257	821,095	1,973,578
Veneer and plywood	80,367	--	8,204	88,571
Total	826,593	406,257	829,299	2,062,149
Total, west coast:				
Lumber	2,207,637	1,692,498	3,742,695	7,642,830
Veneer and plywood	1,445,794	--	174,614	1,620,408
Total	3,653,431	1,692,498	3,917,309	[4/]9,263,238

[1/] Coarse residue includes: (1) From sawmills--slabs, edgings, and sawmill and planer trim; (2) from veneer mills--all wood residues except sawdust and sander dust.

[2/] Medium residue comes only from sawmills and consists of planer shavings.

[3/] Fine residue consists of sawdust and sander dust.

[4/] 53 percent used for fuel, 47 percent unused.

The mission of the PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION is to provide the knowledge, technology, and alternatives for present and future protection, management, and use of forest, range, and related environments.

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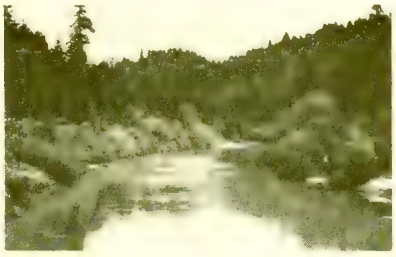
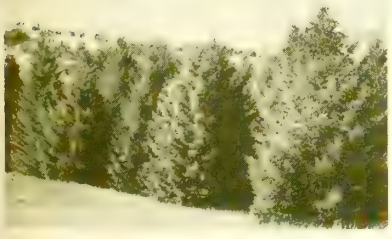
1972

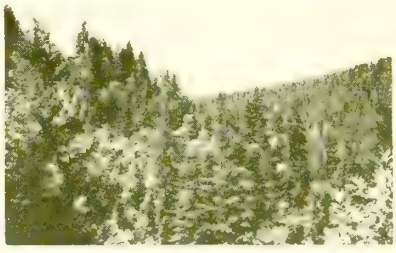
TIMBER RESOURCES OF MENDOCINO AND SONOMA COUNTIES, CALIFORNIA

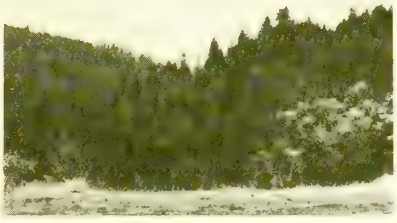
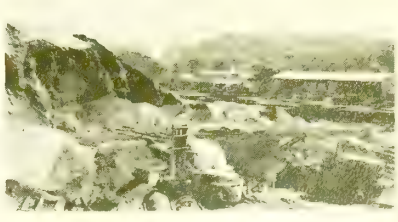
Daniel D. Oswald

OREGON STATE UNIV. NOV 20 1972 FOREST & AGR. DIV. TECH







PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
FOREST SERVICE · U.S. DEPARTMENT OF AGRICULTURE PORTLAND, OREGON

Keywords: Forest surveys, forest appraisal, forest industries, Mendocino and Sonoma Counties, California.

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PREFACE

This report presents the findings of the first complete inventory of timber resources in Mendocino and Sonoma Counties. Past Forest Survey inventories have included these counties, but they were designed to provide only area statistics at the county level; volume estimates were compiled only for large, multi-county regions.

Data for this inventory were collected during several field seasons. On Mendocino National Forest, fieldwork was completed in 1964. Data on lands other than National Forests were collected in the summer of 1965 in Sonoma County and 1967 in Mendocino County.

This inventory was conducted by the Forest Survey, a nationwide project of the Forest Service, U. S. Department of Agriculture, authorized by the McSweeney-McNary Forest Research Act of 1928 and subsequent amendments. The purpose of the Forest Survey is to periodically inventory the extent and condition of forest lands and the amount and kind of timber on them, to determine rates of forest growth and depletion, to estimate timber cut and probable future trends in timber requirements, and to analyze and make available information needed to formulate forest policies and programs. Surveys are made periodically to update basic information.

The Forest Survey is conducted in the various forest regions of the Nation by the U. S. Department of Agriculture Forest Service Experiment Stations. The Pacific Northwest Forest and Range Experiment Station at Portland, Oregon, is responsible for the Forest Survey in California, Oregon, Washington, Alaska, and Hawaii.

ABSTRACT

The findings of the first complete inventory of the timber resources of Mendocino and Sonoma Counties, California, indicate there is 19.1 billion board feet of sawtimber on 1,564,000 acres of unreserved commercial forest land in these two counties. Forest industries own about 34 percent of the commercial forest area and 37 percent of the timber volume; farm and miscellaneous private ownerships account for 53 percent of the area but only 42 percent of the volume; and public ownerships account for 13 percent of the area and 21 percent of the volume.

Almost half the commercial forest area in these two counties is stocked with low value hardwoods and scattered conifers. This condition has resulted from wild fires, logging, and unsuccessful or abandoned attempts to convert timberland to grazing land. Redwood is the area's most abundant conifer, predominating on 368,000 acres; sawtimber volume in this species is 9.6 billion board feet. Douglas-fir type is found on 281,000 acres; sawtimber volume is 6.5 billion board feet.

The forests in these counties are predominantly young, 79 percent of the area having stands under 100 years old. These young forests are responsible for almost all of Mendocino-Sonoma's 499 million board feet of net annual growth.

In recent years, the forest industries of these counties have been utilizing old-growth timber, more Douglas-fir than redwood, and have been relying heavily on their own holdings. In the next 10 to 15 years, the realities of raw material availability will likely lead industry to greater reliance on young redwood sawtimber, much of it from farm and miscellaneous private lands.

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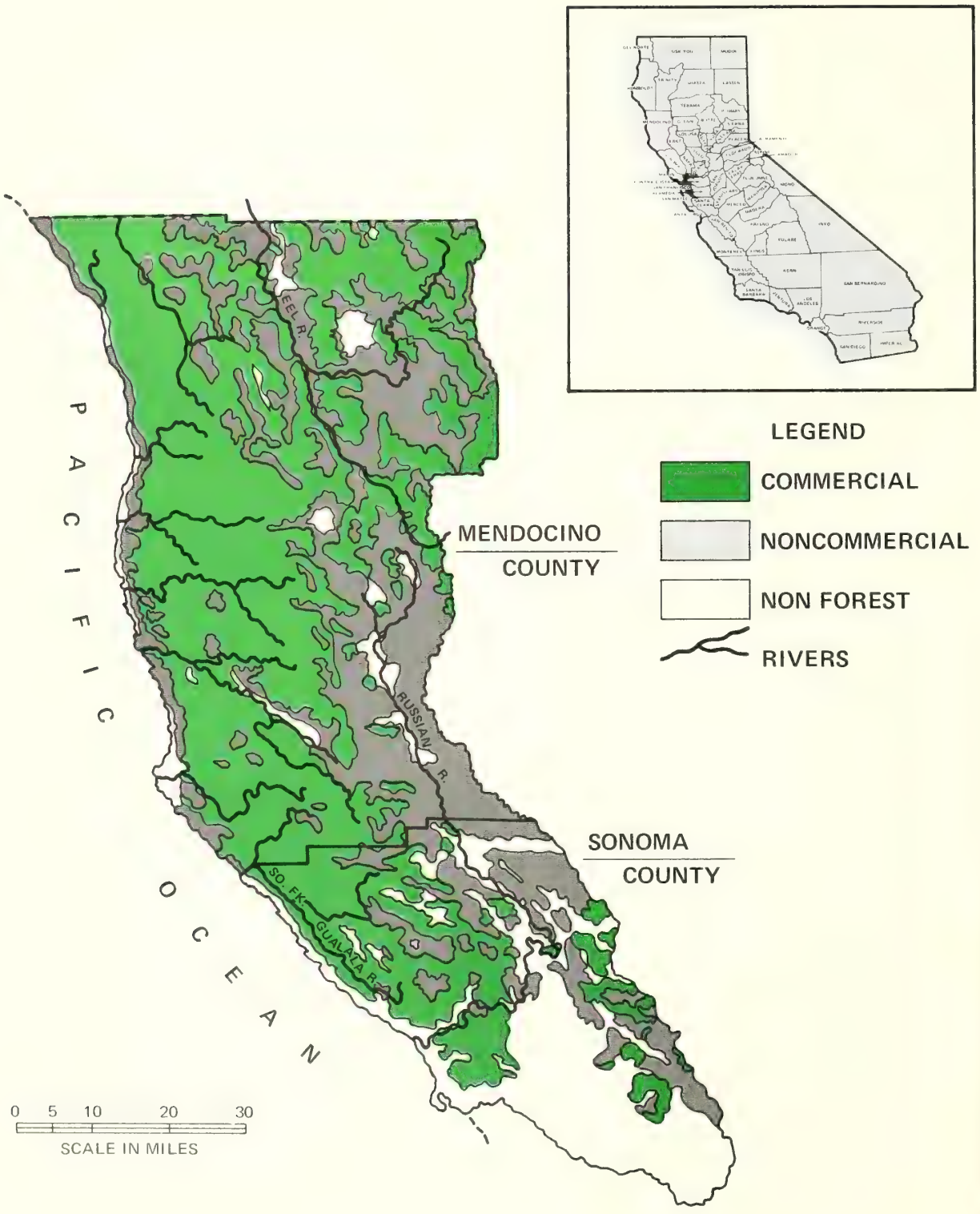


Figure 1. — Forest areas of Mendocino and Sonoma Counties.

INTRODUCTION

The area that is now Mendocino and Sonoma Counties in northern California remained unexplored long after the Spanish had established settlements on the California coast. The Spanish, who were interested in precious metals and furs and needed protected harbors and grazing lands, had avoided the northern coast in favor of the coastal areas south of San Francisco. The mountainous character of the Mendocino-Sonoma area, the rugged coastline without protected natural harbors, and the lack of natural inland transportation routes were contributing causes to the lack of early exploration.

The topography of these two coastal counties is dominated by the two main ridges of the Coast Ranges running from north to south, the higher of the two ridges forming the eastern boundary. The area is drained by two major rivers, the north-flowing Eel River and the south-flowing Russian River. The interior valleys are small and discontinuous, except in southern Sonoma County. The Mendocino coast is characterized by numerous small rivers flowing westward from the western crest of the Coast Ranges (fig. 1). In contrast, the Sonoma coast has few west-flowing streams; the Gualala River, which parallels most of the northern coast of the county a mile or two from tidewater, is a barrier to inland penetration from the coast.

Timber covers much of the area of these two counties (fig. 1). Redwood predominates in the western part of both counties, extending from near the coast to as much as 25 miles inland for the entire length of the Mendocino coast and much of the Sonoma coast. Douglas-fir and other species intermingle with redwood in this belt and predominate in the interior and on the eastern side of the counties.

The establishment of the Russian colony at Fort Ross on the Sonoma coast marked the first settlement in this area. The Russians were attracted by the seals and sea otters and the potential for agriculture and lumber to provide for their Alaska settlements. The first known lumbering in the northern coast occurred in the vicinity of Fort Ross during the period of Russian settlement, 1812 through 1836.

The Spanish, alerted to the Russian colonization in Spanish territory, extended their missions north into Sonoma County in the 1820's. The establishment of missions at Sonoma and Santa Rosa led to the settlement of interior valleys of southern Sonoma County. Land grants were made to Mexican citizens, partially to prevent the Russians' extending their holdings beyond Fort Ross and Bodega. A sea captain, John B. R. Cooper, was granted El Molino Rancho, which extended from near present day Sebastopol to the Russian River. On this property, Cooper constructed California's first waterpowered sawmill in 1834 (Bauer 1951). Cooper's mill produced little if any lumber before being destroyed by a flood. Sonoma County was also the site of California's first steampowered mill, established on a land grant by Captain Stephen Smith near Bodega in 1843 (May 1953). Smith's mill operated for several years before being dismantled and moved to the Mendocino coast.

This early Sonoma milling activity, as well as earlier production of hand-hewn and whipsawn lumber and timbers at Fort Ross and Bodega and the missions at Santa Rosa and Sonoma, predated the period of significant lumbering activity in the northern coast — and in California.

Although the earliest timber cutting and first sawmills were located in what became Sonoma County, the Mendocino coast pro-

Figure 2. — Coastal bluff looking south toward Mendocino townsite. On the point of land in the distance, Harry Meiggs commenced operation of Mendocino's first sawmill in 1852.

vided a greater opportunity for development of the lumber industry. All commerce and transportation for this isolated area was by water. Coastal location was necessary for mills producing for coastal or offshore markets. The largest and most easily logged timber — primarily redwood — occurred in the river bottoms of the coastal streams, most of which were on the Mendocino coastline. Commonly, logs were left in the river bottoms until the water level rose following rainstorms and carried the logs downstream to the millsites at or near the coast.

Large-scale development of the industry on the Mendocino coast started in 1852 when Harry Meiggs, using the machinery from Smith's Bodega mill, erected a sawmill at the mouth of Big River (Palmer 1880), the location of the city of Mendocino (fig. 2). The California gold rush had triggered rapid development of San Francisco and other Bay Area communities, including Oakland and San Jose. The limited timber supplies near those cities were rapidly depleted. Mills were built at the mouths of several coastal rivers along the Mendocino coast in the 1850's. These early millsites became some of the earliest communities in Mendocino County.

In the late 1850's, and early 1860's, mills were established in the interior of both counties. Mills were established along the Russian River in Sonoma County to exploit the large redwoods growing on the bottom lands. The North Pacific Coast Railroad later pushed a track north to the Russian River to reach the lumber mills in that area and transport the lumber to San Francisco Bay. The early interior mills in Mendocino County located in the Anderson Valley and near Laytonville, Covelo, Ukiah, and Willits. These mills cut redwood, fir, or pine, depending on location, and supplied local markets.

From these early beginnings, the lumber industry in the Mendocino-Sonoma area grew rapidly and the area became the most important lumber-producing region in the State. Mendocino had six mills operating in 1859. From the early 1860's through the mid-1870's, Mendocino was California's leading lumber county, as the number of mills varied from 10 to 20, and lumber production varied between 30 and 70 million board feet. Although other counties surpassed Mendocino as the leading producer from that time on, the Mendocino industry continued to grow, producing 120 million board feet in 1895. In the first decade of the 20th century, lumber shipments from Mendocino fluctuated between 97 and 219 million board feet; the high point in 1907 was in response to the raw material requirements for

rebuilding San Francisco after the earthquake and fire of 1906. During this period, shingles, cordwood, rail ties, and tanbark (for extraction of tannin used in tanning leather) were companion products to lumber in the northern coast.

From 1910 to 1930, Mendocino production fluctuated around 200 million board feet annually, then plunged to 33 million board feet in the early 1930's, followed by a climb to predepression levels by the end of World War II.

Sonoma County's lumber industry lagged behind Mendocino's during the early years due to the less favorable location of the timber with respect to water transportation. The early mills were smaller than those of the Mendocino coast and probably oriented to production for local needs. But after completion of a rail line linking San Francisco Bay with the timbered inland stretches of the Russian River in the mid-1870's, Sonoma County lumber production spurted ahead, exceeding Mendocino's during the latter half of the 1870's. Peak production during this early history of the county was 60 million board feet in 1876 and again in 1877. By the turn of the century, the limited stands of timber in the Russian River drainage were depleted. The mills and timbering operations moved to inland locations near the northern coast of the county. And in the first two decades of the 20th century, the annual lumber production plummeted to less than 6 million board feet. Production continued to fall during the 1920's, bottoming at 200,000 board feet in 1932. By the end of World War II, production was averaging about 5 million board feet annually.

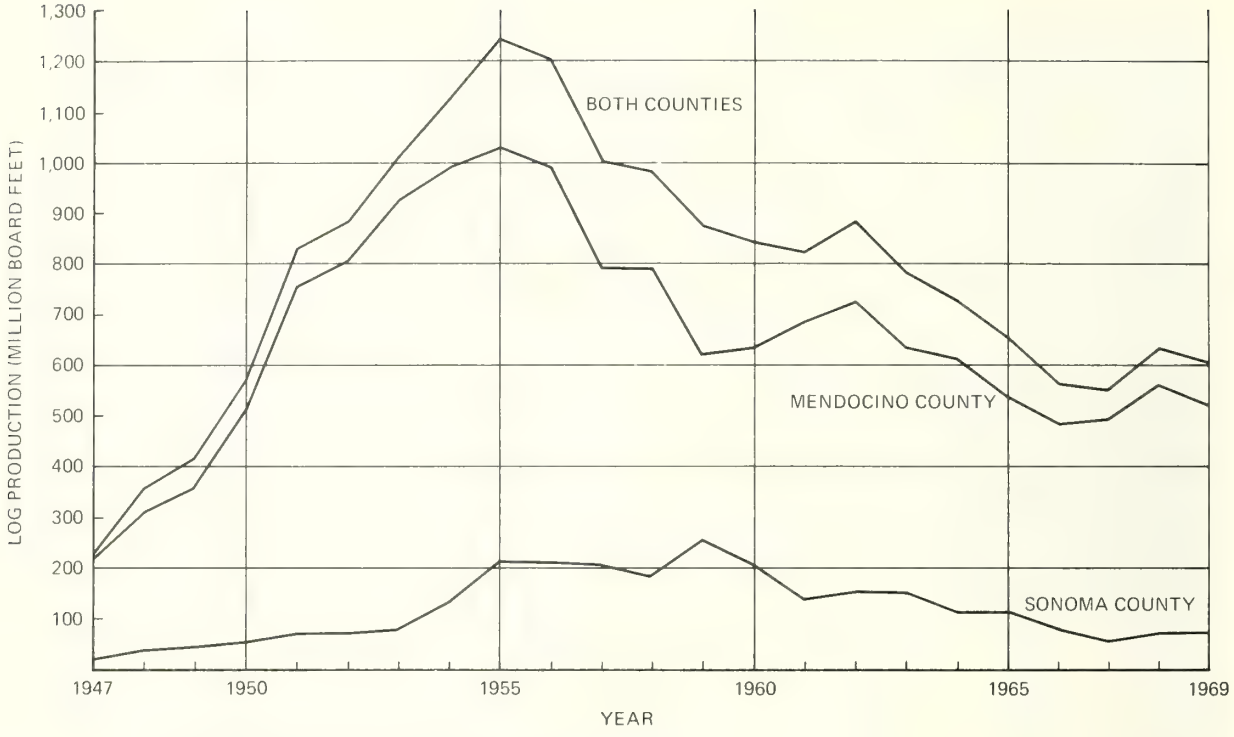
The industry that developed in this first century of lumbering along the California coast — from Santa Cruz north — was oriented to one species, redwood. The location of redwood near the coast and on the river flats, and its many desirable characteristics, led to the development of the "redwood industry." Even as the bull teams and river drives gave way to the more far-reaching combination of donkey engines for skidding and logging railroads, the lumber industry continued to concentrate on the extensive redwood stands in the western parts of the counties. However, other species were harvested. Douglas-fir was sawn and shipped with redwood, and grand fir when encountered was sawn for local use. Tanoak trees were stripped of their bark when found in sufficient quantities, and fuelwood in large quantities was shipped to San Francisco. But most of the timber cut was redwood — probably over 90 percent until 1900, followed by 80 to 90 percent until World War II.

The post-World War II era was accompanied by a building boom in California and the Nation, stimulating interest in the little-used Douglas-fir forests in the interiors of Sonoma-Mendocino, as well as other counties in the northern coast. A new industry, the Douglas-fir lumber industry, rapidly developed, and Douglas-fir production eventually exceeded redwood production. The Douglas-fir plywood industry also became established in Mendocino-Sonoma following World War II.

Log production in Mendocino and Sonoma Counties soared to alltime highs during the 1950's. Mendocino's log harvest was about 1 billion board feet yearly from 1954 through 1956. Sonoma's log harvest exceeded 200 million board feet for 5 of the 6 years from 1955 to 1960 (fig. 3).

Since the peak years — 1955 for Mendocino and 1959 for Sonoma — log harvests have dropped sharply due to depletion of available supplies of privately owned old-growth timber. Mendocino's sharpest declines in log production came in 1957 and 1959; by 1959 log harvest had plummeted nearly 40 percent from the mid-fifties' peak. And after a period of recovery in the early 1960's, Mendocino's log harvest declined again. In 1969 Mendocino's log harvest was 525 million board feet, 51 percent of the peak year harvest and about equal to the 1950 harvest. Sonoma's log harvest had by 1969 declined 70 percent, from 257 million board feet in 1959 to 78 million board feet.

The two counties differ greatly in their dependence on forest industries. Mendocino County's major and dominant industry is still the lumber and wood products industry, despite the decline in timber harvest and product output since the mid-1950's. In 1968, 35 percent of all reported employment was in



SOURCE: CALIFORNIA DIVISION OF FORESTRY (1948-71).

Figure 3. — Log production in Mendocino and Sonoma Counties, 1947-69.

lumber and wood products manufacture. Payrolls in this economic sector totaled over $29 million or 47 percent of the county's total payrolls (California Department of Employment 1969). Mendocino's population in 1970 was unchanged from the 1960 level, reflecting the continued single industry orientation of the economy, and the cessation of growth in that industry.

Sonoma County's economy has outgrown dependence on any single industry. Even before lumbering declined at the turn of the century, agriculture had become increasingly important (fig. 4). Today Sonoma is the northern coast's leading agricultural county; its major products are from dairies, orchards, and vineyards. Within the last three decades, the character of Sonoma's economy has undergone a partial metamorphosis from rural agricultural to urban-suburban. The southern part of the county is within commuting distance of the Bay Area, and the broad expanses of level farmland offer easy opportunities for real estate development. Proximity to the Bay Area has made the county a prime locale for light industry. In addition, Santa Rosa, the county seat, has developed as the major service center for the southern half of the northern coast. In the last decade, the county's economy has achieved a balance between agricultural, manufacturing, and service and trade activities, accompanied by a 39-percent increase in population.

The timberlands and farmlands that account for most of Sonoma County's area still contribute significantly to the economy. In 1968, agriculture accounted for 12 percent of reported employment, and food processing almost 6 percent. Lumber and wood products accounted for 6 percent of reported employment and 8 percent of all payrolls. As a result of the urbanization and economic ties to the Bay Area, the character of this county's forest industry is changing. Although manufacture of primary wood products has declined sharply in the last decade, increases in employment in secondary manufacture of wood products in millwork and prefabrication plants have offset the losses of employment in primary manufacturing.

Figure 4. — Korbel vineyards on former timberlands along the Russian River, Sonoma County. The Korbel brothers, pioneer lumbermen on the Russian River, switched from lumber to grape and wine production after they logged their prime redwood timberlands a century ago.

THE FOREST RESOURCES

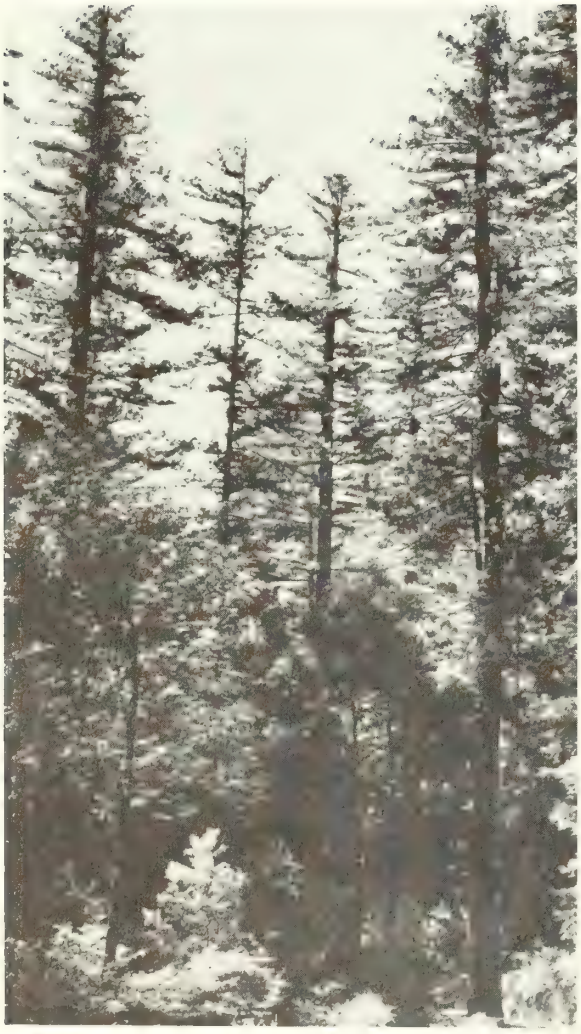


Figure 5.—Old-growth redwood stand in Mendocino County. As the result of 120 years of logging, Mendocino-Sonoma's redwood stands over 100 years old total only 90,000 acres; almost half this acreage has been partially cut.

Sonoma and Mendocino Counties have a combined land area of 3,255,000 acres, 70 percent of which is forested. Commercial forest land[1] totals 1,564,000 acres or 48 percent of the two-county area. Other forested land includes 9,000 acres of productive-reserved forests in State parks and 714,000 acres of unproductive forest land. The latter area is forested with chapparal or hardwoods of no commercial value; its major values are for watershed, livestock grazing, and wildlife habitat.

The commercial forests of Mendocino and Sonoma[2] Counties contain an estimated 19.1 billion board feet (International 1/4-inch rule) of sawtimber; 17.8 billion board feet or 93 percent of the volume is in softwood species and 1.3 billion board feet is in hardwood species. In terms of cubic feet of growing stock, the resource totals 4.3 billion cubic feet: 3.6 billion cubic feet or 85 percent in softwood species, and 661 million cubic feet in hardwood species.

Redwood is most extensive coniferous type

The redwood forest type occupies 368,000 acres or 24 percent of the commercial forest land area of Mendocino-Sonoma (fig. 5). Most commercial scale timber harvesting operations occur in coniferous types. Although redwood occupies only a fourth of the total commer-

[1] *Definitions of terms used in this report are in "Definition of Terms."*

[2] *The two-county area will hereafter be referred to as Mendocino-Sonoma.*

cial forest area, it accounts for half the area in coniferous types. Despite extensive cutting in the past, it is still the dominant conifer in these counties.

The redwood forests of this area are set apart from those of the counties to the north by a break in the natural redwood range in southern Humboldt County, a few miles north of the Mendocino County line. The type extends — unbroken — from the Mendocino-Humboldt County line for 100 miles to 1 mile north of the Russian River in Sonoma County. From the river, it extends about 10 miles farther south. The redwood type, though not tolerant of direct exposure to ocean winds (Roy 1966), is found within a mile of the ocean along much of the Mendocino-Sonoma coast.

This type extends inland less than 10 miles in northern Mendocino and is found as far as 20 miles inland near Willits in central Mendocino; in Sonoma the type occurs generally within 5 to 15 miles of the coast. Isolated stands are found in southeastern Sonoma County, 25 miles inland.

Although the redwood type is generally thought to consist of pure stands of redwood, such stands occur in relatively limited areas, on the moist alluvial flats of coastal streams and on the lower slopes and benches below 1,000 feet in elevation (Roy 1966). Most of the redwood forest type is composed of mixed stands in which redwood predominates. Douglas-fir, its most common conifer associate, is found throughout the redwood type range. Grand fir and western hemlock are also found in the redwood stands near the coast of Mendocino-Sonoma. Sugar pine is found in a very limited area in northwestern Sonoma County. Common hardwood associates are tanoak and madrone; other hardwood associates include California laurel, bigleaf maple, and red alder.

The redwood forest type contains 8.97 billion board feet (International 1/4-inch rule) of sawtimber — 47 percent of Mendocino-Sonoma's sawtimber volume and, of more significance, 59 percent of the sawtimber volume found in coniferous stands. The average sawtimber volume per acre in the redwood forest type is 24,400 board feet.

Redwood stands are mostly young

It is not surprising that in recent efforts to establish more redwood parks, little attention has been focused on Mendocino-Sonoma's redwoods. Cutting on the original redwood stands in these counties has come almost full circle. Of the 368,000 acres in this type, 278,000 acres (75 percent) are stocked by stands under 100 years old. And of the 90,000 acres of redwoods over 100 years, almost half (42,000 acres) have been partially cut at some time in the past.

Douglas-fir type covers large area

Douglas-fir is the predominant species on 281,000 acres or 18 percent of the Mendocino-Sonoma's commercial forest area. Douglas-fir accounts for 38 percent of the area of coniferous forests in the two counties. It intermingles with the redwood type through much of western Mendocino-Sonoma but is the predominant coniferous type at higher elevations and on the drier exposures. Douglas-fir stands in the interior are often found interspersed with noncommercial forest land and natural grasslands. They intermingle with ponderosa pine and white fir stands in the higher elevations of northeastern Mendocino County.

Common conifer associates of Douglas-fir in the Douglas-fir type include redwood in the western part of the two counties and ponderosa pine and white fir in eastern Mendocino County. Common hardwood associates include tanoak, madrone, California black oak, and canyon live oak.

The Douglas-fir type contains 4.98 billion board feet of sawtimber, 26 percent of the sawtimber volume in the two counties. Douglas-fir stands average only 17,700 board feet per acre, reflecting their young age structure; over three-fourths of the Douglas-fir stands are less than 100 years old.

Hardwood types cover almost half of Mendocino-Sonoma's commercial forest area

Hardwood forests combined occupy 768,000 acres or 49 percent of Mendocino-

Sonoma's commercial forest area. Tanoak is the principal species on 418,000 acres; this forest type occupies more area than any other in the two-county area. Other hardwood types include Pacific madrone (100,000 acres), California black oak (63,000 acres), and Oregon white oak (61,000 acres).

The hardwood forests in Mendocino-Sonoma frequently contain substantial amounts of redwood, Douglas-fir, or pines — the conifer component depending on the location of the hardwood stand. Although the hardwoods are the more numerous species, there is usually more softwood sawtimber volume in the hardwood stands of Mendocino-Sonoma; three-fourths of the sawtimber volume in the hardwood type is accounted for by conifers.

Figure 6. — Hardwood stands, such as this tanoak, occupy 768,000 acres or 49 percent of the commercial forest land in Mendocino-Sonoma. Most of this area is capable of producing coniferous timber crops and has conifers scattered among the hardwoods.

The average sawtimber volume per acre in the hardwood types — for both hardwood and softwood species — is about 5,000 board feet, of which 3,700 board feet per acre is in softwood species. Because of today's economics of utilization and available alternatives, most of the hardwood type area is not being logged. Although almost half of Mendocino-Sonoma's commercial forest area is composed of these types, they contain only 3.87 billion board feet (20 percent) of Mendocino's sawtimber. The tanoak type, the most prevalent of the hardwood types, contains 2.6 billion board feet of sawtimber.

Capability of hardwood type area to support conifers offset by other factors

The presence of conifers in most of the hardwood type area in these two counties is an indication of changes from conifer types to hardwoods that have taken place in the past. Most of the hardwood type area has supported predominantly coniferous forests at some time in the past. Ninety-seven percent (747,000 acres) of the hardwood type is on land capable of producing crops of coniferous species.

Some of the hardwoods have followed wild fires, which have periodically denuded large acreages throughout Mendocino-Sonoma. But much of the conversion from conifer to hardwood type is a result of man's activities. In the early days of logging, it was common practice to burn all remaining vegetation and slash after the trees were felled to facilitate removal of the logs. Thus, hardwoods often succeeded conifers — especially when repeated fires occurred in the cutover areas.

In recent years, much logging has been guided by "economic selection." The merchantable timber was felled and unmerchantable trees — often predominately hardwoods — were left. Even though coniferous seed trees have been left on logged lands as required by the California Forest Practices Act (State of California n.d.), the residual hardwoods, many of which sprout and are prolific seed producers, often rapidly dominate such areas (fig. 6).

Figure 7. — A successful conversion of timberland to grazing land in western Mendocino County. This area was converted to grassland by repeated fires following harvest of the redwoods. Redwood stump sprouts have persisted despite the repeated fires.

Attempted conversion of timberland for other uses, primarily grazing, has also contributed to the extensive hardwood acreage. Conversion of timberland for grazing and farming undoubtedly dates back to the earliest days of settlement and homesteading in Mendocino-Sonoma. Repeated fires or logging followed by repeated fires were techniques used. Many of the bona fide conversion attempts were successful, as evidenced by the many "stump ranches" visible on the Mendocino-Sonoma landscape (fig. 7).

However, many conversion attempts have been unsuccessful in varying degrees. Although there are no records, studies of recent timberland conversion attempts indicate a high degree of failure.

Since 1946, timberland conversions have required filing of a timberland conversion affidavit with the California Division of Forestry, in accordance with the California Forest Practices Act of 1945. In an eight-county area of northwestern California that includes Mendocino-Sonoma, timberland conversion affidavits have been filed for 545,000 acres since 1946. Evidence that these conversions are many times unsuccessful is found in two unpublished surveys — conducted by the Division of Forestry — of timberlands for which conversion affidavits were filed. In the most recent study, 57 percent of the area of timberland conversions filed for in California between 1946 and 1960 was sampled in 1964. It was found that on timberland cutover under conversion affidavit, conversion to grassland was completed on only 17 percent of the area. Conversion was incomplete on 70 percent of the area and abandoned on 13 percent. Partially completed or abandoned conversions are certainly a significant factor con-

Figure 8. — Incomplete conversions of timberland to grazing land are a familiar sight on the Mendocino-Sonoma landscape. Such practices often result in the conversion of conifer timberlands to low value hardwoods.

tributing to the large acreage of hardwood type found in Mendocino-Sonoma today (fig. 8).

Mendocino-Sonoma's forests are predominately young growth

Young-growth forests — under 100 years old — occupy 1,242,000 acres or 79 percent of the commercial forests of Mendocino and Sonoma Counties. Even-aged stands account for 735,000 acres or 59 percent of the young growth. The historical evolution of cutting and subsequent second growth establishment has created an uneven distribution of area and volume in these even-aged forests (fig. 9). The 80- to 100-year-old stands, which were formed in the most accessible areas in the early days of logging, total only 51,000 acres. There are 146,000 acres in stands 60 to 80 years old; 168,000 acres in stands 40 to 60 years old; and 82,000 acres in 20- to 40-year-old stands. Even-aged stands originating in the last 20 years total 288,000 acres, 39 percent of Mendocino-Sonoma's young even-age stands.

This uneven-age class distribution will probably be of little significance in constraining the timing of wood supply availability in Mendocino-Sonoma. Half of the area and three-fourths of the sawtimber volume in young even-aged stands are in stands 40 years and older — with most of the area and volume in the 40- to 80-year range. Similar volume and area distributions probably occur in the mixed-age young forests. Though the oldest and largest of the young timber is preferred by processors, an expanding young-growth economy will likely accept all ages of young sawtimber in the timber markets. This should make most timber over 40 years old mer-

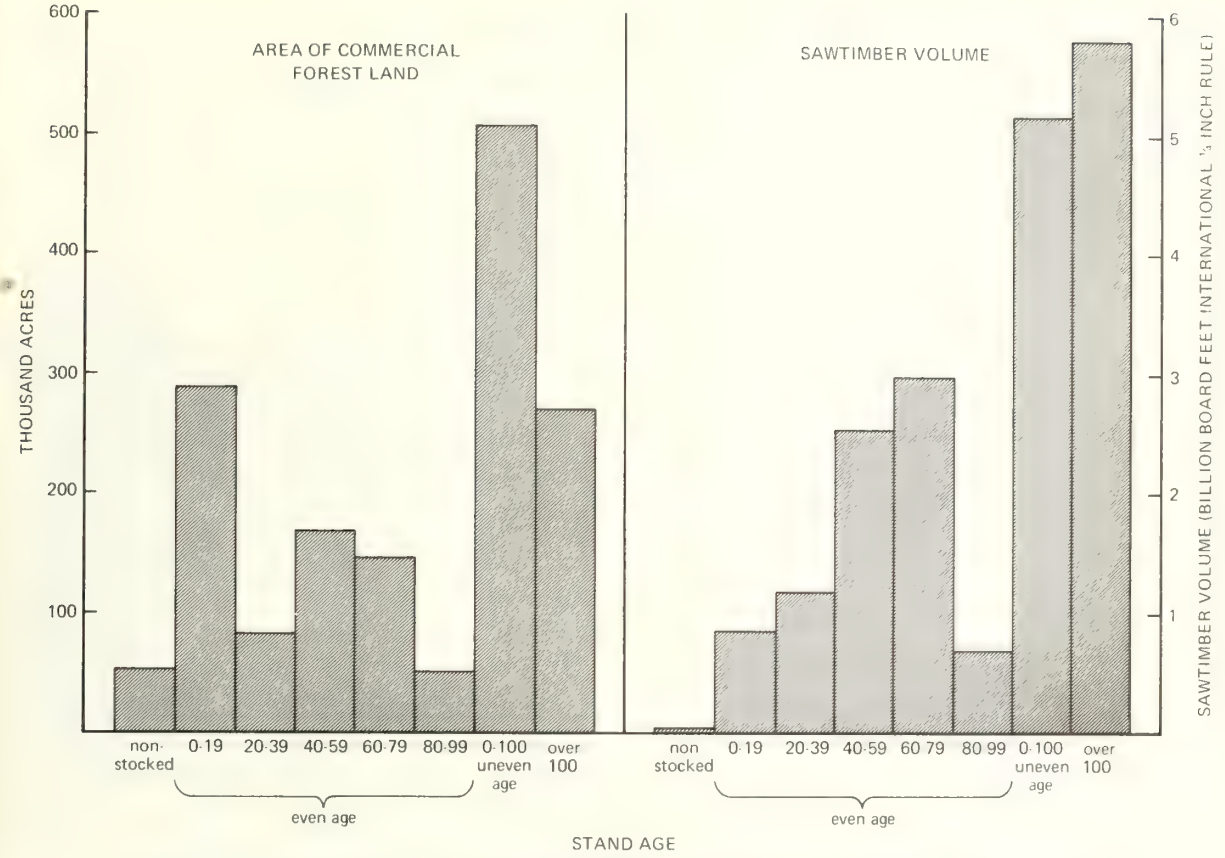


Figure 9. — Area of commercial forest land and sawtimber volume by age class.

chantable and minimize the significance of the seemingly unbalanced age class distribution in the area.

Most of timbered area is stocked with sawtimber

Mendocino-Sonoma's commercial forest land is stocked primarily with sawtimber stands. These stands account for 1,118,000 acres or 71 percent of the commercial forest area of the two counties. The remaining area has poletimber stands (56,000 acres), sapling and seedling stands (337,000 acres), and nonstocked conditions (53,000 acres).

The coniferous stands in Mendocino-Sonoma are mostly sawtimber stands. Of the 743,000 acres of coniferous type, 645,000 acres (87 percent) are stocked with sawtimber. Fully 90 percent of the important redwood type area has sawtimber size stands. The hardwood types are more evenly distributed among all size classes than are the conifers; 62 percent of their area is sawtimber and 38 percent, poletimber, seedlings, and saplings. The hardwood types account for three-fourths of all poletimber and seedling and sapling stands in Mendocino-Sonoma. The concentration of stands of small tree sizes — especially seedlings and saplings — in the hardwood types is yet another indication of the magnitude of the hardwood intrusions onto cutover conifer lands.

Three-fourths of Mendocino-Sonoma's sawtimber area has stands less than 100 years old (fig. 10). This 853,000-acre area contains 12.3 billion board feet of sawtimber, almost two-thirds of the area's sawtimber volume. Average per-acre volume in these stands is about 14,400 board feet.

Old-growth sawtimber stands total 265,000 acres and contain 5.8 billion board feet of sawtimber. Much of the old-growth area has been partially cut in the past, resulting in lower stand volumes than might be ex-

Figure 10. — Young-growth sawtimber stands occupy 853,000 acres of Mendocino-Sonoma's commercial forest area and account for almost two-thirds of the sawtimber volume in the two counties. This young redwood forest is near the coast in Mendocino County.

pected. The average per-acre volume in these stands in Mendocino-Sonoma is 21,700 board feet.

Redwood is most abundant species; Douglas-fir is second

Mendocino-Sonoma's redwoods — more numerous than the ubiquitous tanoak — have a sawtimber volume of 9.6 billion board feet or 50 percent of the area's sawtimber volume. Although the redwood forests are predominately young growth, 83 percent of the redwood volume is in trees 19 inches and larger in diameter; 50 percent of the volume is in trees 29 inches and larger.

Douglas-fir sawtimber volume is 6.5 billion board feet, 34 percent of Mendocino-Sonoma's total sawtimber. Eighty-three percent of Douglas-fir volume is in trees over 19 inches and 54 percent is in trees 29 inches and larger. The remaining softwood species — true firs, ponderosa pine, and other conifers — total 1.8 billion board feet or 9 percent of the area's sawtimber. These species, which are relatively old and have not been extensively cut, have 60 percent of their sawtimber volume in trees over 29 inches in diameter.

The sawtimber volume for hardwood species is only 1.3 billion board feet. Tanoak accounts for almost half, with substantial quantities of Pacific madrone, California black oak, and canyon live oak.

Though the hardwoods account for only 7 percent of Mendocino-Sonoma's sawtimber volume, their share of cubic growing-stock volume is 661 million cubic feet, or 15 percent of the two-county total. The hardwoods do not grow as large as the conifers, and their

numbers and volume are more heavily concentrated in poletimber-size trees; 27 percent of all hardwood cubic volume is in poletimber trees, compared with only 5 percent for conifer species.

Apparent change in commercial forest area is slight

Mendocino and Sonoma Counties were first inventoried as part of the Forest Survey in 1948 (Baker and Poli 1951, 1952). These earlier inventories provided estimates only of area and ownership — no estimates were developed for inventory volumes or growth. Consequently, only area statistics can be compared.

The definition of commercial forest land has remained essentially unchanged. Although designs of the samples used to estimate commercial forest area have changed, impacts of these changes on the estimates are thought to be slight. The **apparent** decrease in commercial forest area in Mendocino-Sonoma between 1948 and 1968 is only 37,000 acres or about 2 percent of the 1948 base. Evidently the conversion of timberlands to other uses has had less impact than generally believed. This is due to the low success rate of timberland conversion to range and to the offsetting effect of volunteer reforestation of former grazing lands.

No direct comparison of forest type acreages can be made between the published data in the earlier reports and the estimates in this report. The earlier estimates were based upon economics-oriented type definitions that defined areas in terms of presence of valuable species (i.e., redwood), gave less weight to species of less value at that time (i.e., Douglas-fir), and did not consider species with little or no economic value at that time (i.e., hardwoods). Nonstocked areas and areas stocked by hardwoods were classed as coniferous types, based on evaluation of potential to grow conifers. The economic classification, depending as it does on recognition of only the conifer component of the stand, is not sensitive to changes in the total stand. Current type definitions are biologic in nature — that is, classification of an area is based on what is growing on it in most abundance; no relative weights based on economic value are assigned. And the basic difference in sampling techniques — generalized cover type mapping in 1948 and point sampling in the recent inventories — further hinders direct comparisons.

In order to compare extent of forest types for the two inventory periods, it was necessary to recalculate forest types for both inventories on a common base. In terms of the earlier economics-oriented types, the distribution of commercial forest area among those types has remained unchanged in Mendocino-Sonoma over the last 20 years. In other words, if we had conducted the most recent inventory using the 1948 definitions, area by forest type in 1968 would have remained about the same.

Although the forest-type data for the earlier inventory could not be recast in the current type definitions to allow comparisons, study of the current inventory data — and field observation — indicates that in terms of biologic type, considerable changes have taken place in recent years. If we could state the type acreages of the earlier as well as present inventory in terms of a biologic type, we would find an increase in hardwood types at the expense of conifer type acreages.

GROWTH AND MORTALITY

Net annual growth is 499 million board feet

The net annual growth of sawtimber in Mendocino-Sonoma is 499 million board feet, International 1/4-inch rule, 2.6 percent of the sawtimber inventory. In comparison, net annual growth for all of California is about 1 percent of the State's sawtimber inventory. Mendocino-Sonoma's high rate of timber growth reflects the preponderance of young stands and good sites. The average growth per acre for all commercial forest land in the two-county area is 319 board feet.

Redwood is most important growth component

Net annual sawtimber growth in the redwood forest type is 280 million board feet, or 56 percent of all sawtimber growth in Mendocino-Sonoma. The annual growth per acre averages 761 board feet. Well-stocked young redwood stands on the best sites in these counties far exceed this average, with 2,000 to 2,800 board feet per acre reported. The redwood type exceeds all others in sawtimber growth and yields. Within its natural range, it should be the favored type if maximum wood production becomes a goal of forest management.

Sawtimber growth for the redwood species — regardless of type occurrence — is 298 million board feet, 60 percent of all sawtimber growth in Mendocino-Sonoma and two-thirds of all softwood sawtimber growth. The young-growth trees of this species — trees under 100 years of age — account for 270 million board feet or over 90 percent of all redwood sawtimber growth.

Douglas-fir forests, second in economic importance only to redwood, account for over 93 million board feet or 19 percent of all sawtimber growth. The per-acre growth is not half that of redwood. Sawtimber growth for the Douglas-fir species is substantially higher than for the forest type, reflecting the widespread occurrence of this tree species in other forest types. Sawtimber growth for this species totals 131 million board feet, 26 percent of all sawtimber growth and 29 percent of softwood sawtimber growth. A considerable amount of the Douglas-fir growth is accruing on scattered trees within the hardwood type; much of this growth is not economically available due to low volume concentrations and may not become so for many years.

The hardwood types combined have sawtimber growth of 103 million board feet, 21 percent of the sawtimber growth for Mendocino-Sonoma. Much of the growth in these hardwood stands is on softwoods, primarily Douglas-fir. Seventy-two million board feet, or 70 percent of the sawtimber growth, and half of the growing-stock growth in these stands is accruing on softwood trees.

The following tabulation presents sawtimber growth by species on coniferous and on hardwood types. Numbers are in million board feet, International 1/4-inch rule:

	Total	Soft-wood	Hard-wood
Coniferous types	396	384	12
Hardwood types	103	72	31
All types	499	456	43

Growth as a percent of sawtimber inventory is about 2.7 percent in the hardwood type forests. But this statistic in itself is mis-

leading; the low inventory density of these stands results in an annual per-acre growth of only 134 board feet compared with an average per-acre growth of 533 board feet in the coniferous types.

The hardwood species, in contrast to the hardwood type, accounts for only 43 million board feet of sawtimber growth, less than 9 percent of the sawtimber growth in the two counties. However, over 20 percent of all growing-stock growth is accounted for by hardwood species, an indication of the large numbers of small hardwood trees.

Mortality is light in Mendocino-Sonoma's young forests

Average annual mortality for the 5-year period preceding the inventory was 49.4 million board feet — one-quarter of 1 percent of the sawtimber inventory. Growing-stock losses averaged 10 million cubic feet annually. Over 70 percent of the sawtimber mortality was in Douglas-fir. This species suffered losses in the early and mid-1960's from storms and insects; in addition, concentrations of old-growth Douglas-fir in some public ownerships have been susceptible to substantial losses from disease. Average annual mortality for Douglas-fir was 35 million board feet, about one-half of 1 percent of sawtimber inventory.

The true firs in Mendocino-Sonoma occur primarily in old stands. These old firs are susceptible to disease and other destructive agents; mortality averaged over 8 million board feet annually — a loss in excess of 1 percent of true fir sawtimber inventory. These species accounted for 17 percent of all sawtimber mortality.

Redwood, which is highly resistant to insects and disease, has sawtimber mortality of less than 1 million board feet annually, a negligible percentage of the redwood sawtimber inventory.

Salvable dead sawtimber totals 134 million board feet

Sound dead sawtimber in Mendocino-Sonoma totals 134 million board feet, over 80 percent of which is Douglas-fir. This material is salvable only in the sense that it would have value for conversion into wood products if it were sufficiently concentrated and conveniently located for economically feasible harvest. Most of this dead material is scattered throughout the timberlands of these two counties. Over two-thirds of it occurs in per-acre concentrations of less than 2,500 board feet. Generally, the only part of this sound dead sawtimber that is economically salvable consists of large concentrations that have resulted from fires, insects, or wind damage; or scattered trees that either can be harvested with green timber or are next to existing roads.

CHARACTERISTICS OF TIMBER RESOURCE OWNERSHIP IN MENDOCINO AND SONOMA COUNTIES

Public timberlands

The public forest lands of Mendocino-Sonoma are administered by four government agencies — three Federal and one State. Collectively they account for 206,000 acres of commercial forest land, 13 percent of the two-county total. This commercial forest acreage in public ownerships is 47,000 acres less than was reported for 1948. This decrease is due largely to the return of tax-deeded properties — lands deeded to the State due to tax delinquency — to the private tax rolls through public sale or redemption by prior owners.

The land administered by the U. S. Forest Service is within the Mendocino National Forest in the northeastern part of Mendocino County (fig. 11). Commercial forest area in this ownership totals 107,000 acres, about half the publicly owned commercial timberlands, but only 7 percent of all timberlands in the two-county area. Sawtimber volume on the National Forest land totals almost 2.3 billion board feet or 12 percent of the two-county total.

The commercial forests in the Mendocino National Forest differ from those of other owners in Mendocino-Sonoma. The forest lands are at higher elevations than those of other owners, some exceeding 6,000 feet. The forests are composed of a mixture of species — Douglas-fir, ponderosa pine, and white fir as major components and incense-cedar and sugar pine in lesser amounts.

Douglas-fir predominates on 45,000 acres, white fir on 28,000 acres, and ponderosa pine on 18,000 acres. Sawtimber volume is concentrated in four species: Douglas-fir (995 million board feet), true firs (585 million board feet), ponderosa pine (439 million board feet), and sugar pine (180 million board feet).

Ninety percent of the commercial forest area in the Mendocino National Forest is in sawtimber stands, and almost two-thirds of the forest area is occupied by stands over 100 years of age. These old-growth stands contain 1.9 billion board feet of sawtimber, one-third of the old-growth volume in the two-county area.

The average sawtimber volume per acre here is high — about 21,000 board feet (International 1/4-inch rule); 50 percent of the commercial forest area has stand volumes in excess of 20,000 board feet.

These old stands of timber are susceptible to the higher mortality associated with old age. Average annual mortality on National Forest land was 24 million board feet, almost half of the sawtimber mortality in the two-county area. The mortality — concentrated in Douglas-fir and true firs — averaged 223 board feet per acre. This high mortality and the slow growth of these old stands yield a net annual growth of only 2.8 million board feet, an average of only 26 board feet per acre on National Forest timberlands.

The other publicly owned commercial forest lands in Mendocino-Sonoma are managed by one State and two Federal agencies.

State lands are concentrated in Jackson State Forest, which extends inland from the central Mendocino coast near Fort Bragg. This block of timberland, acquired by the State from industry in 1947, is well stocked with mature young stands of redwood. It is

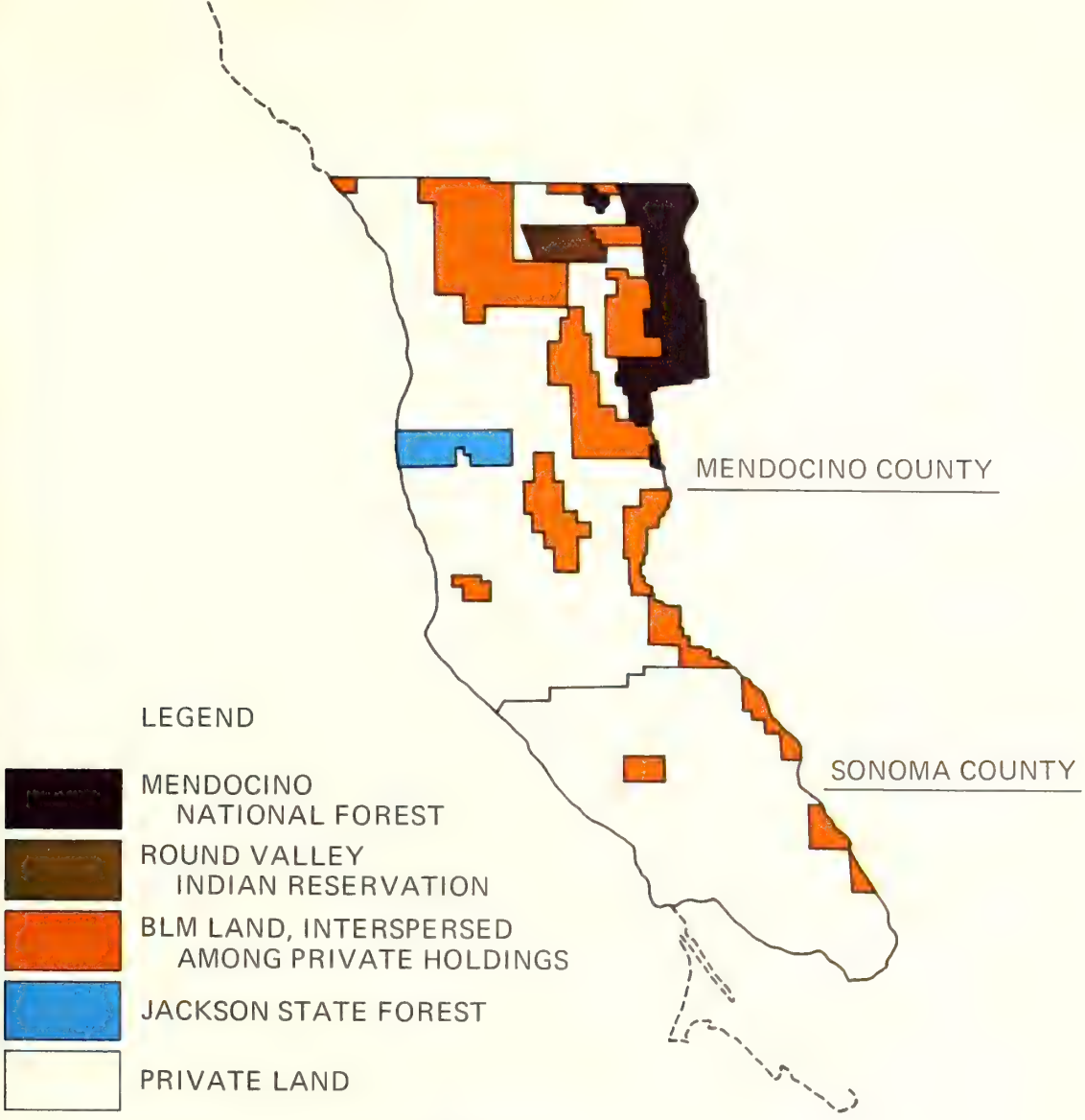


Figure 11. — Land ownership pattern in Mendocino and Sonoma Counties.

managed as a demonstration forest for the production of timber.

The other Federal lands are administered by the Bureau of Land Management (BLM) and Bureau of Indian Affairs (BIA). The BLM forest lands are scattered through much of the eastern half of Mendocino County. The Indian trust forest lands — administered by the BIA — are in the Round Mountain Indian Reservaton in northeastern Mendocino County. The forest lands administered by these two Federal agencies in Mendocino-Sonoma are relatively low in productivity. They are stocked with hardwoods and relatively light concentrations of Douglas-fir and ponderosa pine.

The "other public" ownerships — State, BLM, and BIA — have a total of 99,000 acres of commercial forest land in Mendocino-Sonoma, of which 28,000 acres are redwood type and 9,000, Douglas-fir type. The remainder of the area is occupied by hardwoods, primarily tanoak. These ownerships contain 1.65 billion board feet of sawtimber, 9 percent of the two-county total. Over 1 billion board feet of the sawtimber volume is redwood; most of the remainder is Douglas-fir.

All the acreage in these "other public" ownerships is in young stands, 80 percent of which are sawtimber size. Net annual growth — which totals 50 million board feet — averages over 500 board feet per acre. Seventy percent of this sawtimber growth occurs in

the young stands of redwoods found on State lands. Mortality is negligible, averaging only 4 board feet per acre annually.

Forest industry timberlands

Forest industries own 529,000 acres of commercial forest land, one-third of the two-county total. Although much of this has been held by the forest industries for many years, forest industry ownership of commercial forest land in the past 20 years has increased 35 percent. This increase is largely from ranch holdings that contained substantial tracts of timber. Although the period of expansion of industrial landholdings was largely coincident with the postwar development of the Douglas-fir lumber and plywood industries in Mendocino-Sonoma and north coastal California, industry has continued to acquire available timberlands to this date.

The timberlands owned by forest industry today reflect the long history of cutting in Mendocino-Sonoma — concentrated on the redwood holdings of industry until recent years. Seventy-six percent of the area has forests under 100 years of age. And two-thirds of the 386,000 acres of sawtimber are young stands.

The industry-owned forests have 7.1 billion board feet of sawtimber, 37 percent of the two-county total. The young-growth forests account for almost two-thirds of industry's sawtimber volume. Though old-growth sawtimber stands occupy a smaller area and contain less volume than the young stands in this ownership, the 2.6 billion board feet of old-growth sawtimber in these stands represents almost half of such volume in Mendocino-Sonoma and two-thirds of the old-growth sawtimber in private ownership in these two counties. Considering industry's current preference for old-growth timber, this volume is of considerable importance for the near-term supply of raw material for Mendocino-Sonoma mills.

This ownership has essentially two conifer types — redwood and Douglas-fir. The redwood type, most abundant and important in this ownership, occurs on 171,000 acres. Sawtimber volume in this type totals 4.1 billion board feet, 58 percent of the sawtimber volume in industry ownership. Douglas-fir is predominant on 98,000 acres of industry land, with a volume of 1.3 billion board feet, 18 percent of industry's sawtimber.

The hardwood type is the most prevalent type in industry ownership — as it is for Mendocino-Sonoma as a whole. Hardwoods dominate the stocking on 247,000 acres of industry's commercial forest area. Of the 1.7 billion board feet of sawtimber on these hardwood lands, well over 1 billion board feet is softwood species — mostly Douglas-fir. But the volume concentrations per acre in this type are low, as they are for hardwood stands of all ownerships (fig. 12).

Sawtimber growth on forest industry land totals 174 million board feet, about one-third of the sawtimber growth in Mendocino-Sonoma. Sawtimber growth in this ownership is concentrated in redwood (101 million board feet) and Douglas-fir (55 million board feet). Growth is about 2.5 percent of inventory for both species. This growth rate for redwood is substantially lower than the

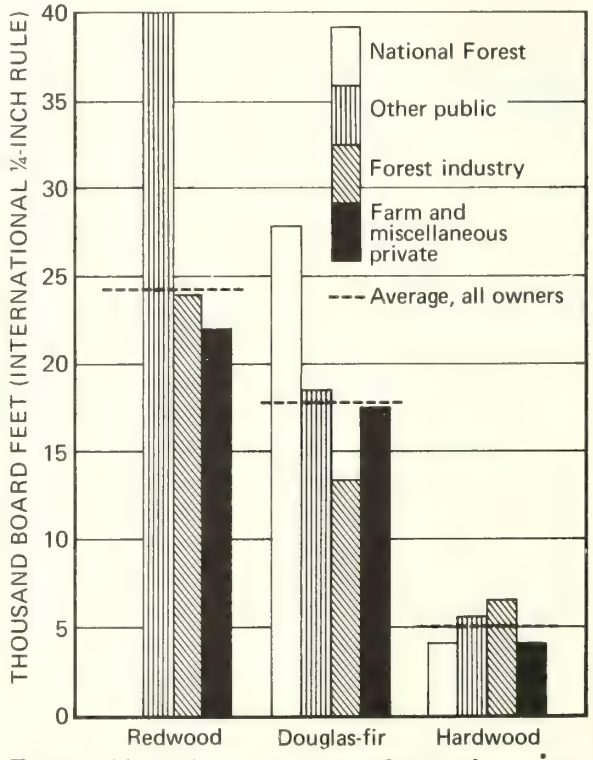


Figure 12. — Average sawtimber volume per acre by forest type and ownership.

3.1-percent rate that characterizes the species for all ownerships; it reflects the substantial balance of slowly growing old growth still existing in this ownership in both residual and uncut stands.

Mortality is negligible — averaging only 22 board feet per acre annually. The low mortality can be attributed to the nature of industry's holdings — predominately redwood. Almost all losses were in Douglas-fir.

Farmer and miscellaneous private timberlands

The farmer and miscellaneous private ownership category is a grouping of many types of owners in terms of intent of owner, type of use made of the timber resources, size of parcel, and many other criteria. This owner group includes ranches of many thousands of acres, tiny farms, and large and small tracts of land held by individuals and corporations — for speculation, development, or recreation. Many are absentee owners, and much of the area has changed hands several times in the last decade.

This potpourri of owners accounts for 829,000 acres of commercial forest land in Mendocino-Sonoma, 53 percent of timberland acreage in the two counties. Comparison with estimates for 1948 yields an apparent decrease of 127,000 acres over the 20-year period. This acreage loss has resulted primarily from acquisition of farm timberlands by industry. Successful conversion of timberlands to nonforest uses (mostly grazing) was evidently of minor consequence in timberland loss in the last 20 years.

The impacts of the extensive logging and unsuccessful timberland conversion in the last two or three decades are reflected by the timberlands in this conglomerate ownership. Five percent of the area is nonstocked; 28 percent is stocked with seedlings and saplings or poletimber; and 58 percent is stocked with young sawtimber stands. Only 72,000 acres of old-growth sawtimber stands remain.

The timberlands contain 8.1 billion board feet of sawtimber, 6.9 billion board feet of which is in young-growth forests. Over half of all young sawtimber volume in Mendocino-Sonoma Counties is in this ownership.

Redwood forest type is the most extensive conifer type in this ownership; it covers 169,000 acres, about the same acreage as owned by industry. These predominantly young stands average 22,100 board feet per acre. Sawtimber volume totals 3.7 billion board feet, almost half of the volume in this ownership.

The Douglas-fir type accounts for 129,000 acres or 16 percent of the timberland controlled by farmers and miscellaneous private owners. These also are mostly young stands, many of which have been partially cut in recent years; they average 17,500 board feet per acre. Sawtimber totals about 2.3 billion board feet or 28 percent of the sawtimber volume in this owner group.

Hardwood types occur on 445,000 acres or 54 percent of all commercial forest land in this ownership. The extent of the hardwood types is due to several factors. The acreage of these owners lies generally to the east of the industry-owned lands, at higher elevation, and is of lower average productivity. These areas in their natural state had larger hardwood components than was true for industry lands. And hardwood succession after cutting presents a greater problem than is the case for the stands on better sites and at lower elevations. Land conversion attempts, which in recent years have been largely unsuccessful and resulted in hardwood succession, have been concentrated on farmer-owned lands. The sawtimber volume in the hardwood type averages only 4,000 board feet per acre, most occurring in conifer species within the hardwood stands.

The distribution of volume by species within this owner group is not what volume distribution by type would indicate. Both Douglas-fir and redwood, as species, account for more volume (about 20 percent) than do their respective types (fig. 13). For both redwood and Douglas-fir, most of the difference between species and forest type volumes is accounted for by the conifer component in the hardwood forest type.

The large acreage of young stands in farmer and miscellaneous private ownerships is reflected in the high net annual growth. Net sawtimber growth is 272 million board feet,

over 54 percent of all sawtimber growth in the two counties. Redwood accounts for 162 million board feet of growth, Douglas-fir growth is 29 million board feet, and hardwood growth is 24 million board feet. The redwood type accounts for 142 million feet of net growth. Growth in this type averages 840 board feet per acre; as a percentage of redwood type inventory, it is an impressive 3.8 percent.

Mortality in the predominantly young stands of this ownership group is negligible, reflecting both the age structures of the stands and the concentration of volume in redwood.

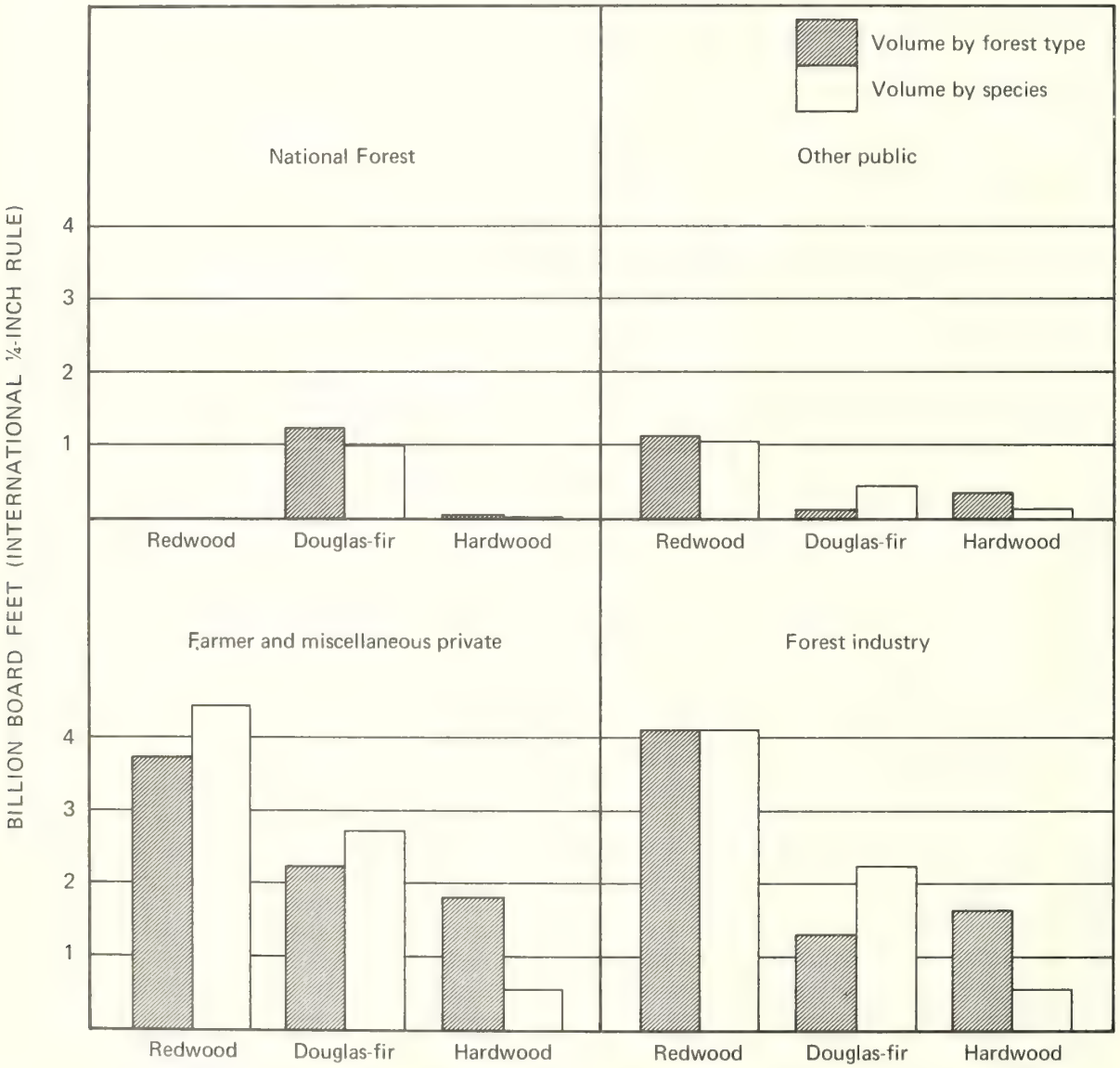


Figure 13. — Sawtimber volume by species, forest type, and ownership.

THE COUNTIES AS RESOURCE UNITS

This report has dealt with Mendocino and Sonoma Counties as one resource unit — in part through necessity,[3] but primarily because the timber industries and the resources of the two counties should logically be grouped. The timber resources of northwestern Sonoma County are the southernmost extensions of the timberlands that extend the length of the northern coastal counties — Del Norte, Humboldt, Mendocino, and Sonoma. And the mills of the two counties exhibit interdependency for raw material. In 1968, almost 12 million board feet of logs moved from Mendocino forests to Sonoma mills for processing (Barrette, Gedney, and Oswald 1970), and chips for board manufacture moved from some of the Sonoma mills to the hardboard plant in Mendocino County.

Following is a brief discussion of some timber resource characteristics that are associated with the individual counties.

[3] *The sampling intensity used on the relatively small forest area of Sonoma County would result in unacceptably large sampling errors for some of the county statistics.*

Recognizing that some users of Forest Survey data will need information for individual counties, we have included county data in the tables where possible. Included are county estimates of commercial forest area by ownership, forest type, and stand size; volume of growing stock and sawtimber by species, forest type, and ownership; net annual growth of sawtimber and growing stock by species and forest type; average annual mortality by species; and volume of salvable dead sawtimber by species. "Reliability of Current Inventory Data" should be consulted to ascertain the size of the sampling errors associated with these—and all other—estimates presented in this report.

Mendocino County

Mendocino County's 2,245,000-acre area is mostly forested; 1,304,000 acres or 58 percent is unreserved commercial forest land. This amounts to 83 percent of the two-county commercial forest area total.

Not surprisingly, Mendocino also accounts for most of the sawtimber and growing-stock volume in the two-county area. The commercial forest lands in this county contain 15.9 billion board feet of sawtimber; growing-stock volume totals 3.6 billion cubic feet.

Mendocino's timber resources can be characterized as predominantly young sawtimber. Sawtimber stands occupy 931,000 acres, or 71 percent of Mendocino's commercial forest area. Over three-fourths of these stands are under 100 years of age, and sawtimber volumes are low; almost a million acres have less than 10,000 board feet per acre, and only 85,000 acres have 20,000 board feet or more.

Mendocino has a "hardwood problem," as do other counties in northern coastal California. Hardwood types dominate 671,000 acres, 51 percent of Mendocino's commercial forest area. Redwood, the major conifer, occurs as principal species on 295,000 acres; Douglas-fir type covers 227,000 acres.

The redwood species totals 7.4 billion board feet in inventory volume; second in importance is Douglas-fir, with 5.6 billion board feet. Redwood also accounts for most of Mendocino's 410 million board feet of sawtimber growth, with 226 million board feet or 55 percent. Douglas-fir growth totals 119 million board feet, or 29 percent of this total.

The commercial forests of Mendocino

County are distributed among both private and public ownerships. Mendocino County has essentially all the publicly owned commercial forest area and timber in the two-county area. The 205,000-acre area of public forests — 16 percent of Mendocino's commercial forest area — contains 3.9 billion board feet of sawtimber, 24 percent of Mendocino's total. Sawtimber growth on public lands — 53 million board feet — is only 13 percent of Mendocino's total. The high sawtimber inventory and low growth in the public ownerships reflect the substantial balance of old-growth timber on National Forest lands.

Forest industries make up the most important ownership group in Mendocino County. This group of wood-processing firms owns 469,000 acres of commercial forest land, 36 percent of the county's total. Because the industrial owners control most of the remaining old growth, they account for 6.7 billion board feet or 42 percent of all sawtimber in Mendocino County. Sawtimber growth totals 167 million board feet.

The acreage of industry-owned forest lands in Mendocino County has grown in recent years, primarily through acquisitions from farm owners. Other changes have also occurred within this owner group. Large integrated forest industrial corporations have acquired timber resources and processing facilities in Mendocino County. Since 1968, Georgia-Pacific has acquired timberlands and sawmills of several companies in this county. And in 1968, Boise Cascade acquired the extensive timber holdings and large processing facilities of Union Lumber Company, the oldest and largest redwood firm in the county and one of the largest in northern coastal California. Longview Fibre has also acquired timberlands in Mendocino. Boise Cascade is adding a particleboard plant to its sawmill and plywood facilities. Masonite Corporation was the first national forest products company to locate in Mendocino, shortly after World War II. These large corporations now control most of the timber resources in industrial ownership in Mendocino; the era of the large, locally controlled "redwood company" here has ended.

The farmer and miscellaneous private ownership group owns 630,000 acres or 48 percent of Mendocino's commercial forest land. Farmers own half of this, the largest owner group. The farmer and miscellaneous private timberlands, stocked predominantly with young stands and hardwood types, contain 5.3 billion board feet or one-third of Mendocino's sawtimber. This ownership group, as was mentioned earlier, is diverse in every respect. The many owners — residents and absentees, farmers, recreationists, and speculators — have diverse reasons for owning timberlands. The management and ownership objectives of this group, unlike those of the public and industry owner groups, cannot be clearly defined. The timing and magnitudes of timber yields from these lands cannot be foreseen with any degree of confidence (fig. 14). But this largest owner group is very important to Mendocino County, for the resource basic to timber production — the land — is concentrated within it. And the young-growth timber inventory and timber growth — ingredients of industry's future — are most abundant. Here seem to reside the problems and the potentials of Mendocino's future.

Sonoma County

Sonoma County's land area is 1,010,000 acres. Commercial forest area totals 260,000 acres or 26 percent of the total land area. Sonoma's commercial forests contain over 3.2 billion board feet of sawtimber; growing stock totals 691 million cubic feet.

About 85 percent of Sonoma's forests are less than 100 years old. And these young forests account for over two-thirds of the county's sawtimber volume.

Half of Sonoma's timberlands are stocked with conifers; redwood type accounts for 73,000 acres and Douglas-fir, 53,000 acres. The hardwood type occurs on 97,000 acres, most of which is capable of supporting conifers. Nonstocked areas in this county total 32,000 acres or 13 percent of the commercial forest area.

Redwood is this county's most abundant timber species. Redwood sawtimber totals 2.2 billion board feet; growth in this species is 73 million board feet, 81 percent of Sonoma's 89 million board feet of sawtimber growth.

Figure 14. — Mendocino County, though more distant from the San Francisco area than Sonoma County, has received considerable attention from developers in recent years. Recreational subdivisions remove land from the commercial forest land base, even if no homes are built. Small parcel sales (inset) fragment larger ownerships and — though the land remains in the commercial forest land base — future timber yields will likely be diminished.

Douglas-fir sawtimber totals 893 million board feet; growth in this species is less than 13 million board feet or 14 percent of Sonoma's total. It is interesting to note that even though redwood dominates in inventory, growth, and area, in 1968 this species supplied only 37 percent of the logs consumed by resident industries.

The ownership pattern in Sonoma County is unlike that in Mendocino County. Public timberlands are practically nonexistent here, totaling less than 1,000 acres. The dominant ownership group is farmer and miscellaneous private with 199,000 acres or 77 percent of the commercial forest land; almost two-thirds of this is owned by farmers (fig. 15). The volume is heavily concentrated on the farmer and miscellaneous private lands, which contain 2.8 billion board feet or 88 percent of Sonoma's sawtimber. Growth is also aggregated in this owner group, to an even greater degree than is area or volume; growth in this owner group totals 82 million board feet, 92 percent of Sonoma County's sawtimber growth.

It is apparent that Sonoma County's forest industries must look to farmer and miscellaneous private timber owners for their present as well as future log supplies. In 1968 over two-thirds of the logs consumed by Sonoma industries came from this owner group.

For this county, the future of the timber economy is uncertain. The current timberland ownership pattern gives few clues as to the intentions of owners regarding timber production. Some industry lands have been sold off in 40-acre parcels in recent years, further complicating the determination of owner's in-

Figure 15. — This mosaic of forests, range, and orchards is a familiar sight on the farm ownerships in Sonoma County. The future of Sonoma County's primary forest products industries depends on continued yields from the forest lands of small private owners.

tentions. And Sonoma's timberlands are within a 1- to 2-hour drive of the 4.5 million people who reside around San Francisco Bay. The attractiveness of Sonoma's timberlands for recreation is apparent and is enhanced by the Russian River as well as the rugged Sonoma coast and Sonoma's redwoods.

Recreational subdivision of Sonoma's timberlands dates back at least to 1895, when Meeker (Bauer 1951) advertised his cutover timberlands south of the Russian River for summer home development (fig. 16). Today almost all the timbered area adjoining the Russian River and its major tributaries are recreational properties (fig. 17). These developments have taken much of the most productive forest land out of production. And now, recreational second home developments are appearing on the county's north coast.

The ownership pattern in this county, its attractiveness for recreation, and its location near the Bay Area are strong indications that further trade of timber production for recreational use will be forthcoming.

Figure 16. — Weekend retreat at Camp Meeker in Sonoma County. Land sales in this second home subdivision commenced in 1895 after lumberman Meeker had cut the old redwoods. These 75-year-old redwoods — and many more like them — are not likely to contribute raw material for Sonoma's forest industries.

Figure 17. — The Russian River is a major weekend and summer retreat for residents of the Bay Area. In addition to swimming and boating in the summer months, this stream provides winter recreation for many steelhead fishermen. Summer cabins, resorts, and homes of full-time residents are found throughout the young redwood forests along the river.

THE RESOURCE AND DEPENDENT INDUSTRIES

Mendocino-Sonoma had 33 operating sawmills in 1968 (Barrette, Gedney, and Oswald 1970). Their combined productive capacity per 8-hour shift was almost 2.5 million board feet. Over 20 percent of the sawmilling capacity was in medium- to large-sized mills — mills with capacity exceeding 80,000 board feet per 8-hour shift. Rounding out the primary processing facilities engaged in wood products manufacture in 1968 were two softwood plywood plants and a hardboard plant. The latter operates on residues from sawmills and plywood plants.

Mendocino-Sonoma timber resource supplies resident industries

The log consumption by Mendocino-Sonoma sawmills and plywood plants totaled 633 million board feet in 1968, while timber harvested in the two counties totaled 619 million board feet.

Log shipments to and from these counties were not substantial. Movements from the counties were limited to: 10 million board feet of logs from Sonoma and Mendocino to Bay Area export docks, 4 million board feet of Mendocino logs to Humboldt County, and 10 million board feet of Mendocino logs to Glenn and Tehama Counties. Logs coming into the two counties included 31 million board feet from Humboldt County, 5 million board feet from Lake County, and 2 million from several other counties. Mendocino-Sonoma can certainly be characterized as self-sustaining in terms of resource supply for its forest industries.

Cut is concentrated in old-growth timber

Though the forests in Mendocino-Sonoma are predominantly young growth, 61 percent of the logs consumed by forest industries in these two counties came from old-growth trees. At first glance, this might seem to be an imbalance in resource use. However, it must be recognized that there still exists 5.8 billion board feet of timber in old-growth stands within the two counties. This old growth occurs in higher per-acre concentrations than younger timber, and industry is generally better equipped to process large old timber than small young timber. Industry owns 45 percent of the existing old-growth sawtimber, making such raw material readily available.

At 1968 harvest levels, the remaining privately owned old-growth softwood sawtimber could last 10 years, provided most of the old sawtimber residuals become economically available. Old-growth sawtimber from the Mendocino National Forest will be available — under current cutting trends — for many years to come.

Cut-growth comparisons

Cut-growth comparisons cannot properly be used to evaluate cutting impacts in old stands that are realizing little or no net growth. Nor should they be used in evaluation of cutting activities in a combined resource of both old and young stands. In old-growth stands, timber harvest activities are often planned to remove the old timber reserves at a rate that will create a manageable second forest with desired age structure. For land managers who are also plant operators, the old-growth removal rate must provide adequate raw material to the plant operation for a period of time until the oldest young growth is merchantable.

The continued availability of young-growth sawtimber is often equated with growth. That is, a young forest can indefinitely support a cut equal to its annual growth. While this concept is generally applied to so-called fully regulated forests — forests that have the desired stand structure and age class distribution — it is also useful in

evaluating use of less than fully regulated forests, such as the composite of young forests in Mendocino-Sonoma. In such forests, comparison of cut and growth indicates whether inventories are increasing or decreasing.

Growth exceeds cut in young sawtimber stands

Mendocino-Sonoma industries depended on young growth for 247 million board feet or 39 percent of their logs in 1968. Softwood growth in young stands totaled about 410 million board feet in 1968, considerably more than was cut from these stands. The excess of growth over cut in the young stands — if this level of cutting continues — will allow the inventory in young stands to increase; growth will also increase.

However, one question that should be raised is: "How much of this growth will actually be available for harvest eventually?" Considerable growth accrues on lands owned by persons who might have no intention of selling timber. However, intent of ownership was not gaged in this survey, and in the past it has been a transitory factor, often changing with the owner. Considerable growth occurs on softwoods scattered throughout the hundreds of thousands of acres occupied by hardwoods. For the most part, this volume is not economically usable due to the low concentrations. How much might eventually become available is problematical. If one assumes that all this growth is unavailable, over 70 million board feet of growth should be discounted. Given this assumption, the "available" growth in young conifers is about 340 million board feet annually; this reduced growth still exceeds substantially the 1968 young-growth consumption by resident industries and would allow inventory and growth increases at 1968 cutting levels.

Douglas-fir is still major species used by resident industries

The shift in species use in Mendocino-Sonoma that occurred after World War II is still evident today. Prior to the war, 80 to 90 percent of the raw material used for wood products in the two counties was redwood; by 1946, redwood and Douglas-fir were equally cut. By 1956, Douglas-fir made up 55 percent of the cut, compared with 41 percent for redwood; this difference was less by 1968 — 49 percent compared with 44 percent. In 1968, Mendocino-Sonoma industries used 311 million board feet of Douglas-fir and 275 million board feet of redwood. Forty-six million board feet of other softwoods and 1.5 million board feet of hardwoods rounded out the 1968 consumption.

Decline in Douglas-fir harvest will continue

Following its peak in the mid-1950's, Douglas-fir harvest in Mendocino-Sonoma declined to less than half by 1968. The following analysis indicates that further decline in the harvest of this species will occur in the near future. The harvest in 1968 was almost 5 percent of the standing inventory. And since the cut exceeded the 131-million-board-foot growth in this species by almost 140 percent, continued cutting at 1968 levels will continue to substantially reduce the Douglas-fir inventory. Since the Douglas-fir harvest is largely still dependent on old-growth timber, continued reduction of inventory is to be expected. However, at current cutting levels, old-growth Douglas-fir on private lands will be exhausted in less than a decade. When this happens, if the cut falls to the level of growth, it appears that substantial dislocations in Mendocino-Sonoma's Douglas-fir processing industries will be imminent. The questionable availability of much of the Douglas-fir growth occurring in hardwood stands does not brighten the prospects for future availability.

Redwood harvest can be maintained

Redwood harvest, like that of Douglas-fir, has declined substantially — to a little more than half of the 1956 level. But the 1968 harvest level for this species can be maintained — and likely increased — in the future. The cutting rate for redwood is less than 3 percent of the inventory — and slightly less than the growth rate. Although the current cut is still more than half old growth, a shift of all cutting to young growth could be maintained by the 270 million board feet of gr wth now occurring in young redwood stands. The cutting of old-growth redwood will likely continue

for another 10 to 15 years; if total redwood harvest remains stable at the 1968 level, inventory and annual growth in young stands will increase, and these stands will be able to sustain — on a cut equals growth basis — a larger cut than the total redwood harvest for 1968.

Most logs came from industry lands

In 1968, 55 percent of the logs used by resident industries in Mendocino-Sonoma came from industry lands. Farmer and miscellaneous private lands provided 30 percent, and the remainder were from public lands. Since industry owns only 37 percent of the sawtimber in the two counties, a first appraisal might be that the cut is disproportionately heavy. However, industry accounts for 45 percent of the old-growth sawtimber volume in the two counties — and over two-thirds of the privately held old growth. And since the cut is still concentrated in old growth, it follows that it would therefore concentrate in the ownership that accounts for such timber.

When the harvest shifts more to young growth in the near future, the percentage contribution of industry lands to total harvest may well decline. This is likely because industry currently accounts for only about one-third of the young-growth inventory and the sawtimber growth in Mendocino-Sonoma.

Farmer and miscellaneous private lands should be increasingly important

Farmer and miscellaneous private timberlands account for more area, inventory, and growth than any other owner group in Mendocino-Sonoma. In 1968, about 190 million board feet, or 30 percent of the total, was cut from these lands. This owner group is in a position — from the resource availability standpoint — to increase its future contribution to the Mendocino-Sonoma harvest. Almost all of this land has young stands and, as the harvest shifts to young growth, it will likely shift to this ownership, which currently accounts for over half of Mendocino-Sonoma's young sawtimber inventory and 54 percent of sawtimber growth. Currently, sawtimber growth exceeds cut on farmer and miscellaneous private lands by about 80 million board feet, and inventory and growth on these lands are increasing.

The outlook for forest industries

For Mendocino-Sonoma, much of the painful process of adjusting to declining harvest due to old-growth depletion has passed. It seems likely that soon — perhaps within 10 to 15 years — the timber harvest in Mendocino-Sonoma will have shifted from old-growth stands to young-growth stands; that redwood will once again become the largest component of timber harvest; and that the farmer and miscellaneous private ownerships will become more important suppliers of logs, as they were in the Douglas-fir boom of the 1950's.

What will Mendocino-Sonoma's future timber harvest level be? If it is assumed that the timber harvest will remain at current levels for the next decade, and if that cut is concentrated in old-growth timber, inventory and growth in young stands will increase to a level at which an annual cut of about 500 million board feet will be sustainable on the basis of conifer growth. This is about 80 percent of recent harvest levels.

However, given the reality of economically unavailable softwoods in hardwood stands and the prospect of conversion of timberland to other uses, a sustainable cut of 500 million board feet may be unobtainable.

Conversely, timber yields on Mendocino-Sonoma's timberlands can be increased through intensified timber management practices such as planting, precommercial and commercial thinning, and converting hardwood stands to conifer species. The characteristics of many of the individual owners in the farmer and miscellaneous private group — small parcels, short tenure, and nontimber-production goals — make investment in such practices very unlikely for much of the area in this largest ownership group. Consequently, a substantial part of Mendocino-Sonoma's timberlands cannot be counted on to produce timber at nearly their potential. Increased yields through intensified management practices, if they are to occur, will likely be on those public and forest industry lands for which timber production is the primary long-term goal.

Table 1. — Area by land class and county, Mendocino and Sonoma Counties, California, January 1, 1968

(In thousand acres)

Land class	All counties	Mendocino	Sonoma
Forest:			
Commercial	1,564	1,304	260
Productive reserved	9	6	3
Unproductive	714	469	245
Total	2,287	1,779	508
Nonforest[1]	968	466	502
Total area[2]	3,255	2,245	1,010

[1] *Includes swampland, cropland, pasture and range, industrial and urban areas, other nonforest land, and 25,000 acres classed as water by Forest Survey standards, but defined by the Bureau of the Census as land.*

[2] *Source: U.S. Bureau of the Census, Land and Water Area of the United States, 1960, revised 1965.*

Table 2. — Area of commercial forest land, by ownership class and county, Mendocino and Sonoma Counties, California, January 1, 1968

(In thousand acres)

Ownership class	All counties	Mendocino	Sonoma
National Forest	107	107	---
Other public:[1]			
Bureau of Land Management	45	44	1
Indian	13	13	---
State	41	41	([2])
Total other public	99	98	1
Private:			
Forest industry	529	469	60
Farmer-owned	438	314	124
Miscellaneous private	391	316	75
Total private	1,358	1,099	259
All classes	1,564	1,304	260

[1] *Estimates of commercial forest land in specific ownerships are derived by sampling methods. Consequently, they may not agree with the official estimates of the individual agencies.*

[2] *Less than 500 acres.*

Table 3. — Area of commercial forest land, by stand-size, age, and ownership classes, Mendocino and Sonoma Counties, California, January 1, 1968

(In thousand acres)

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Sawtimber stands:					
Old growth	265	68	---	125	72
Young growth	853	28	80	261	484
Total	1,118	96	80	386	556
Poletimber stands	56	4	5	5	42
Sapling and seedling stands	337	5	14	129	189
Nonstocked areas	53	2	---	9	42
All classes	1,564	107	99	529	829

Table 4. — Area of commercial forest land, by county, stand-size, age, and ownership classes, Mendocino and Sonoma Counties, California, January 1, 1968

(In thousand acres)

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
			MENDOCINO		
Sawtimber stands:					
Old growth	229	68	---	119	42
Young growth	702	28	79	231	364
Total	931	96	79	350	406
Poletimber stands	56	4	5	5	42
Sapling and seedling stands	296	5	14	114	163
Nonstocked areas	21	2	---	---	19
All classes	1,304	107	98	469	630
			SONOMA		
Sawtimber stands:					
Old growth	36	---	---	6	30
Young growth	151	---	1	30	120
Total	187	---	1	36	150
Poletimber stands	---	---	---	---	---
Sapling and seedling stands	41	---	([1])	15	26
Nonstocked areas	32	---	---	9	23
All classes	260	---	1	60	199

[1] *Less than 500 acres.*

Table 5. — Area of commercial forest land, by stand-size and ownership classes, Mendocino and Sonoma Counties, California, January 1, 1968

(In thousand acres)

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Sawtimber stands:[1]					
21.0 inches and larger	654	66	48	247	293
11.0-20.9 inches	464	30	32	139	263
Total	1,118	96	80	386	556
Poletimber stands	56	4	5	5	42
Sapling and seedling stands	337	5	14	129	189
Nonstocked areas	53	2	---	9	42
All classes	1,564	107	99	529	829

[1] *Mean stand diameter.*

Table 6. — Area of commercial forest land, by stand volume and ownership class, Mendocino and Sonoma Counties, California, January 1, 1968

(In thousand acres)

Stand volume[1]	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Less than 1,500	281	8	11	65	197
1,500 to 4,999	347	18	10	107	212
5,000 to 9,999	355	14	46	126	169
10,000 to 19,999	236	13	5	104	114
20,000 to 29,999	166	19	9	61	77
30,000 to 39,999	78	16	---	27	35
40,000 to 49,999	46	11	---	24	11
50,000 or more	55	8	18	15	14
All classes	1,564	107	99	529	829

[1] *Net volume, board feet per acre, International 1/4-inch rule.*

Table 7. — Area of commercial forest land, by cubic-foot site and ownership classes, Mendocino and Sonoma Counties, California, January 1, 1968

(In thousand acres)

Site class [1] (cubic feet)	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
225 or more	167	1	13	66	87
165 to 224	183	5	11	75	92
120 to 164	349	25	23	135	166
85 to 119	361	35	9	123	194
50 to 84	492	34	43	130	285
20 to 49	12	7	---	---	5
All classes	1,564	107	99	529	829

[1] *A classification in terms of capacity for cubic-foot annual growth per acre at culmination of mean annual growth in fully stocked stands.*

Table 8. — Area of commercial forest land, by stocking class of growing-stock trees and by ownership group, Mendocino and Sonoma Counties, California, January 1, 1968

(In thousand acres)

Stocking class	All ownerships	Public	Private
Overstocked (133 percent or more)	61	9	52
Fully stocked (100 to 132 percent)	410	55	355
Medium stocked (60 to 99 percent)	501	100	401
Poorly stocked (16.7 to 59 percent)	539	40	499
Nonstocked (less than 16.7 percent)	53	2	51
All classes	1,564	206	1,358

Table 9. — Area of commercial forest land, by forest type and ownership class, Mendocino and Sonoma Counties, California, January 1, 1968

(In thousand acres)

Forest type	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Douglas-fir	281	45	9	98	129
Redwood	368	---	28	171	169
True firs	33	28	---	---	5
Ponderosa pine	27	18	---	4	5
Bishop pine	24	---	---	---	24
Lodgepole pine	5	---	---	---	5
Incense-cedar	5	---	---	---	5
Red alder	9	---	---	5	4
California black oak	63	10	7	---	46
Oregon white oak	61	1	---	19	41
Pacific madrone	100	---	6	24	70
Tanoak	418	---	32	180	206
Other hardwoods	117	3	17	19	78
Nonstocked	53	2	---	9	42
All types	1,564	107	99	529	829

Table 10. — Area of commercial forest land, by forest type and ownership class, Mendocino County, California, January 1, 1968

(In thousand acres)

Forest type	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Douglas-fir	228	45	8	93	82
Redwood	295	---	28	160	107
True firs	33	28	---	---	5
Ponderosa pine	27	18	---	4	5
Bishop pine	19	---	---	---	19
Lodgepole pine	5	---	---	---	5
Incense-cedar	5	---	---	---	5
Red alder	9	---	---	5	4
California black oak	58	10	7	---	41
Oregon white oak	50	1	---	13	36
Pacific madrone	90	---	6	19	65
Tanoak	374	---	32	156	186
Other hardwoods	90	3	17	19	51
Nonstocked	21	2	---	---	19
All types	1,304	107	98	469	630

Table 11. — Area of commercial forest land, by forest type and ownership class, Sonoma County, California, January 1, 1968

(In thousand acres)

Forest type	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Douglas-fir	53	---	1	5	47
Redwood	73	---	([1])	11	62
True firs	---	---	---	---	---
Ponderosa pine	---	---	---	---	---
Bishop pine	5	---	---	---	5
Lodgepole pine	---	---	---	---	---
Incense-cedar	---	---	---	---	---
Red alder	---	---	---	---	---
California black oak	5	---	---	---	5
Oregon white oak	11	---	---	6	5
Pacific madrone	10	---	---	5	5
Tanoak	44	---	---	24	20
Other hardwoods	27	---	---	---	27
Nonstocked	32	---	---	9	23
All types	260	---	1	60	199

[1] *Less than 500 acres.*

Table 12. — Area of commercial forest land by forest type, stand-size class, and ownership, Mendocino and Sonoma Counties, California, January 1, 1968

(In thousand acres)

Forest type and stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Douglas-fir:					
Sawtimber	244	45	9	66	124
Poletimber	---	---	---	---	---
Seedling & sapling	37	---	---	32	5
Redwood:					
Sawtimber	330	---	28	147	155
Poletimber	---	---	---	---	---
Seedling & sapling	38	---	---	24	14
True firs:					
Sawtimber	26	26	---	---	---
Poletimber	7	2	---	---	5
Seedling & sapling	---	---	---	---	---
Ponderosa pine:					
Sawtimber	16	16	---	---	---
Poletimber	2	2	---	---	---
Seedling & sapling	9	---	---	4	5
Bishop pine:					
Sawtimber	24	---	---	---	24
Poletimber	---	---	---	---	---
Seedling & sapling	---	---	---	---	---
Lodgepole pine:					
Sawtimber	5	---	---	---	5
Poletimber	---	---	---	---	---
Seedling & sapling	---	---	---	---	---
Incense-cedar:					
Sawtimber	---	---	---	---	---
Poletimber	---	---	---	---	---
Seedling & sapling	5	---	---	---	5
Hardwoods:					
Sawtimber	473	9	43	174	247
Poletimber	47	---	5	4	38
Seedling & sapling	248	5	14	69	160
Nonstocked	53	2	---	9	42
All types:					
Sawtimber	1,118	96	80	387	555
Poletimber	56	4	5	4	43
Seedling & sapling	337	5	14	129	189
Nonstocked	53	2	---	9	42
Total	1,564	107	99	529	829

Table 13. — Area of commercial forest land and volume of growing stock and sawtimber[1] by stand age and ownership classes, Mendocino and Sonoma Counties, California, January 1, 1968

Stand age class (years)	All ownerships			National Forest			Other public			Forest industry			Farmer and miscellaneous private		
	Area	Growing stock	Sawtimber	Area	Growing stock	Sawtimber	Area	Growing stock	Sawtimber	Area	Growing stock	Sawtimber	Area	Growing stock	Sawtimber
	Thousand acres	*Million cubic feet*	*Million board feet*	*Thousand acres*	*Million cubic feet*	*Million board feet*	*Thousand acres*	*Million cubic feet*	*Million board feet*	*Thousand acres*	*Million cubic feet*	*Million board feet*	*Thousand acres*	*Million cubic feet*	*Million board feet*
Nonstocked	53	7	24	2	(2)	---	---	---	---	9	1	---	42	6	24
0 - 9	210	151	579	---	---	---	15	21	79	78	66	268	117	64	232
10 - 19	78	70	257	---	---	---	4	2	7	37	50	199	37	18	51
20 - 29	27	30	94	---	---	---	---	---	---	4	7	18	23	23	76
30 - 39	55	259	1,080	---	---	---	9	103	504	18	72	266	28	84	310
40 - 49	69	260	1,132	1	1	1	---	---	---	20	89	408	48	170	723
50 - 59	99	335	1,374	3	1	3	5	30	135	24	99	377	67	205	859
60 - 69	81	369	1,669	3	2	8	---	---	---	18	148	690	60	219	971
70 - 79	65	278	1,320	3	4	13	14	61	305	14	45	192	34	168	810
80 - 89	35	119	603	1	5	22	11	51	263	---	---	---	23	63	318
90 - 99	16	23	71	---	---	---	11	19	67	---	---	---	5	4	4
100 - 119	19	76	375	---	---	---	---	---	---	5	21	98	14	55	277
120 - 139	10	9	47	---	---	---	---	---	---	---	---	---	10	9	47
140 - 159	5	15	60	---	---	---	---	---	---	5	15	60	---	---	---
160 - 179	10	35	154	---	---	---	---	---	---	5	26	115	5	9	39
180 - 199	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
200 and over	90	491	2,637	40	202	1,227	---	---	---	44	274	1,319	6	15	91
Uneven-aged under 100 years	507	1,234	5,157	26	67	322	30	73	288	178	491	2,054	273	603	2,493
Uneven-aged over 100 years	135	525	2,504	28	119	661	---	---	---	70	229	1,023	37	177	820
All classes	1,564	4,286	19,137	107	401	2,257	99	360	1,648	529	1,633	7,087	829	1,892	8,145

[1] *International 1/4-inch rule.*

[2] *Less than 500,000 cubic feet.*

Table 14. — Area of noncommercial forest land, by forest type, Mendocino and Sonoma Counties, California, January 1, 1968

(In thousand acres)

Forest type	All noncommercial areas	Productive-reserved areas	Unproductive areas
Douglas-fir	17	4	13
Redwood	8	3	5
Pines	2	1	1
True firs	5	---	5
Oak-madrone	387	---	387
Other hardwoods	53	1	52
Chaparral	251	---	251
All types	723	9	714

Table 15. — Number of growing-stock trees on commercial forest land, by diameter and ownership classes, Mendocino and Sonoma Counties, California, January 1, 1968

(Thousands of trees)

Diameter class (inches at breast height)	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
5.0 - 6.9	41,667	1,812	3,847	14,115	21,893
7.0 - 8.9	28,725	1,177	1,395	12,365	13,788
9.0 - 10.9	19,961	1,348	1,279	7,813	9,521
11.0 - 12.9	15,575	862	1,449	4,913	8,351
13.0 - 14.9	12,005	598	1,073	4,250	6,084
15.0 - 16.9	9,375	439	736	3,305	4,985
17.0 - 18.9	6,523	344	577	2,441	3,161
19.0 - 20.9	4,818	128	564	1,537	2,589
21.0 - 28.9	9,452	541	850	3,379	4,682
29.0 - 38.9	3,797	433	328	1,474	1,562
39.0 and larger	1,823	283	134	843	563
All classes	153,721	7,965	12,232	56,435	77,089

Table 16. — Number of growing-stock trees on commercial forest land, by species and diameter classes, Mendocino and Sonoma Counties, California, January 1, 1968

(In thousand trees)

Species	Diameter class (inches at breast height)											
	All classes	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:												
Douglas-fir	27,600	6,528	4,735	2,578	2,573	2,324	1,818	1,737	1,318	2,350	1,032	607
Redwood	46,485	8,266	6,648	5,111	5,456	4,175	3,972	2,665	2,191	4,870	2,122	1,009
Grand fir	2,127	1,123	228	281	97	32	85	74	67	92	26	22
Red fir	83	---	---	---	6	13	---	7	4	26	10	17
White fir	3,048	701	359	514	342	256	185	182	66	294	126	23
Ponderosa pine	1,703	579	217	107	165	65	101	132	12	166	93	66
Sugar pine	202	---	---	---	28	18	49	22	---	24	33	28
Bishop pine[1]	1,450	---	---	266	491	260	184	19	32	175	23	---
Cedars[2]	594	33	160	203	57	23	26	6	20	17	40	9
Western hemlock	348	158	---	154	---	36	---	---	---	---	---	---
Total	83,640	17,388	12,347	9,214	9,215	7,202	6,420	4,844	3,710	8,014	3,505	1,781
Hardwoods:												
Red alder	1,781	264	589	254	229	217	133	65	17	11	2	---
Pacific madrone	7,885	3,130	1,448	1,231	728	540	236	254	118	162	26	12
Tanoak	42,283	15,058	10,999	6,155	3,512	2,455	1,715	918	526	793	136	16
California black oak	3,385	475	642	345	782	557	115	147	99	156	60	7
Canyon live oak	3,846	418	401	864	553	645	497	111	136	185	36	---
Oregon white oak	4,135	1,643	980	828	301	74	85	45	120	59	---	---
Other oaks	1,972	1,023	207	463	45	189	---	41	1	---	---	3
California laurel	3,859	2,005	1,020	471	126	58	55	37	54	17	12	4
Other hardwoods	935	263	92	136	84	68	119	61	37	55	20	---
Total	70,081	24,279	16,378	10,747	6,360	4,803	2,955	1,679	1,108	1,438	292	42
All species	153,721	41,667	28,725	19,961	15,575	12,005	9,375	6,523	4,818	9,452	3,797	1,823

[1] *Includes lodgepole pine.*

[2] *Primarily incense-cedar.*

Table 17. — Volume of growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods, Mendocino and Sonoma Counties, California, January 1, 1968

Ownership class	Volume per acre	Total volume		
		All species	Softwoods	Hardwoods
	Cubic feet	*Million cubic feet*		
Growing stock:				
National Forest	3,748	401	397	4
Other public	3,636	360	289	71
Forest industry	3,087	1,633	1,354	279
Farmer and miscellaneous private	2,282	1,892	1,585	307
All ownerships	2,740	4,286	3,625	661
	Board feet	*Million board feet*		
Sawtimber (International 1/4-inch rule):				
National Forest	21,093	2,257	2,246	11
Other public	16,646	1,648	1,497	151
Forest industry	13,397	7,087	6,553	534
Farmer and miscellaneous private	9,825	8,145	7,553	592
All ownerships	12,236	19,137	17,849	1,288
Sawtimber (Scribner rule):				
National Forest	19,813	2,120	2,109	11
Other public	15,556	1,540	1,392	148
Forest industry	12,499	6,612	6,090	522
Farmer and miscellaneous private	9,125	7,565	6,990	575
All ownerships	11,405	17,837	16,581	1,256

Table 18. — Volume of growing stock and sawtimber on commercial forest land, by stand-size class and by softwoods and hardwoods, Mendocino and Sonoma Counties, California, January 1, 1968

Stand-size class	Volume per acre	Total volume		
		All species	Softwoods	Hardwoods
	Cubic feet	*Million cubic feet*		
Growing stock:				
Sawtimber stands	3,549	3,968	3,413	555
Poletimber stands	1,268	71	41	30
Sapling and seedling stands	712	240	167	73
Nonstocked areas	132	7	4	3
All classes	2,740	4,286	3,625	661
	Board feet	*Million board feet*		
Sawtimber (International 1/4-inch rule):				
Sawtimber stands	16,127	18,030	16,929	1,101
Poletimber stands	3,125	175	143	32
Sapling and seedling stands	2,694	908	763	145
Nonstocked areas	453	24	14	10
All classes	12,236	19,137	17,849	1,288

Table 19. — Volume of timber on commercial forest land, by class of timber and by softwoods and hardwoods, Mendocino and Sonoma Counties, California, January 1, 1968

(In million cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Saw-log portion	3,668	3,307	361
Upper-stem portion	262	142	120
Total	3,930	3,449	481
Poletimber trees	356	176	180
All growing-stock	4,286	3,625	661
Sound cull trees	127	21	106
Rotten cull trees	261	148	113
Salvable dead sawtimber trees	22	20	2
Total, all timber	4,696	3,814	882

Table 20. — Volume of growing stock and sawtimber on commercial forest land, by county and ownership class, Mendocino and Sonoma Counties, California, January 1, 1968

County	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
			Million cubic feet		
Growing stock:					
Mendocino	3,595	401	358	1,543	1,293
Sonoma	691	---	2	90	599
Total	4,286	401	360	1,633	1,892
			Million board feet		
Sawtimber (International 1/4-inch rule):					
Mendocino	15,907	2,257	1,638	6,695	5,317
Sonoma	3,230	---	10	392	2,828
Total	19,137	2,257	1,648	7,087	8,145
Sawtimber (Scribner rule):					
Mendocino	14,821	2,120	1,530	6,249	4,922
Sonoma	3,016	---	10	363	2,643
Total	17,837	2,120	1,540	6,612	7,565

Table 21. — Volume of growing stock on commercial forest land by species and ownership class, Mendocino and Sonoma Counties, California, January 1, 1968

(In million cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	1,273	173	80	442	578
Redwood	2,008	---	207	878	923
Grand fir	46	---	---	19	27
White fir	105	104	---	1	---
Red fir	13	13	---	---	---
Ponderosa pine	101	69	2	12	18
Sugar pine	29	28	---	1	---
Bishop pine[1]	37	---	---	---	37
Cedars[2]	11	10	---	---	1
Western hemlock	2	---	---	1	1
Total	3,625	397	289	1,354	1,585
Hardwoods:					
Red alder	20	([3])	1	14	5
Pacific madrone	99	---	13	44	42
Tanoak	354	---	34	179	141
California black oak	58	3	2	9	44
Canyon live oak	52	1	18	15	18
Oregon white oak	26	---	---	8	18
Other oaks	12	---	1	---	11
California laurel	17	---	1	3	13
Other hardwoods	23	---	1	7	15
Total	661	4	71	279	307
All species	4,286	401	360	1,633	1,892

[1] *Includes 7 million cubic feet of lodgepole pine.*

[2] *Primarily incense-cedar.*

[3] *Less than 500,000 cubic feet.*

Table 22. — Volume of growing stock on commercial forest land by species and county, Mendocino and Sonoma Counties, California, January 1, 1968

(In million cubic feet)

Species	All counties	Mendocino County	Sonoma County
Softwoods:			
Douglas-fir	1,273	1,072	201
Redwood	2,008	1,572	436
Grand fir	46	43	3
White fir	105	105	---
Red fir	13	13	---
Ponderosa pine	101	101	---
Sugar pine	29	28	1
Bishop pine[1]	37	35	2
Cedars[2]	11	11	---
Western hemlock	2	2	---
Total	3,625	2,982	643
Hardwoods:			
Red alder	20	19	1
Pacific madrone	99	97	2
Tanoak	354	334	20
California black oak	58	55	3
Canyon live oak	52	51	1
Oregon white oak	26	23	3
Other oaks	12	11	1
California laurel	17	10	7
Other hardwoods	23	13	10
Total	661	613	48
All species	4,286	3,595	691

[1] *Includes 7 million cubic feet of lodgepole pine.*

[2] *Primarily incense-cedar.*

Table 23. — Volume of sawtimber on commercial forest land by species and ownership class, Mendocino and Sonoma Counties, California, January 1, 1968 (International 1/4-inch rule)

(In million board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	6,458	995	460	2,277	2,726
Redwood	9,573	---	1,026	4,114	4,433
Grand fir	202	---	---	84	118
White fir	524	518	---	6	---
Red fir	67	67	---	---	---
Ponderosa pine	620	439	11	65	105
Sugar pine	184	180	---	4	---
Bishop pine[1]	168	---	---	---	168
Cedars[2]	50	47	---	---	3
Western hemlock	3	---	---	3	---
Total	17,849	2,246	1,497	6,553	7,553
Hardwoods:					
Red alder	52	2	3	30	17
Pacific madrone	165	---	17	78	70
Tanoak	631	---	73	330	228
California black oak	144	8	3	26	107
Canyon live oak	136	1	51	39	45
Oregon white oak	39	---	---	11	28
Other oaks	15	---	1	---	14
California laurel	23	---	---	1	22
Other hardwoods	83	---	3	19	61
Total	1,288	11	151	534	592
All species	19,137	2,257	1,648	7,087	8,145

[1] *Includes 30 million board feet of lodgepole pine.*

[2] *Primarily incense-cedar.*

Table 24. — Volume of sawtimber on commercial forest land by species and ownership class, Mendocino and Sonoma Counties, California, January 1, 1968 (Scribner rule)

(In million board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	6,013	941	431	2,121	2,520
Redwood	8,878	---	951	3,818	4,109
Grand fir	188	---	---	79	109
White fir	479	474	---	5	---
Red fir	63	63	---	---	---
Ponderosa pine	584	416	10	60	98
Sugar pine	175	171	---	4	---
Bishop pine[1]	151	---	---	---	151
Cedars[2]	47	44	---	---	3
Western hemlock	3	---	---	3	---
Total	16,581	2,109	1,392	6,090	6,990
Hardwoods:					
Red alder	51	2	3	29	17
Pacific madrone	161	---	16	76	69
Tanoak	616	---	72	322	222
California black oak	142	8	4	25	105
Canyon live oak	133	1	49	38	45
Oregon white oak	39	---	---	11	28
Other oaks	14	---	1	---	13
California laurel	22	---	---	2	20
Other hardwoods	78	---	3	19	56
Total	1,256	11	148	522	575
All species	17,837	2,120	1,540	6,612	7,565

[1] *Includes 27 million board feet of lodgepole pine.*

[2] *Primarily incense-cedar.*

Table 25. — Volume of sawtimber on commercial forest land, by species and county, Mendocino and Sonoma Counties, California, January 1, 1968 (International ¼-inch rule)

(In million board feet)

Species	All counties	Mendocino County	Sonoma County
Softwoods:			
Douglas-fir	6,458	5,565	893
Redwood	9,573	7,370	2,203
Grand fir	202	196	6
White fir	524	524	---
Red fir	67	67	---
Ponderosa pine	620	620	---
Sugar pine	184	180	4
Bishop pine[1]	168	161	7
Cedars[2]	50	50	---
Western hemlock	3	3	---
Total	17,849	14,736	3,113
Hardwoods:			
Red alder	52	45	7
Pacific madrone	165	160	5
Tanoak	631	602	29
California black oak	144	135	9
Canyon live oak	136	133	3
Oregon white oak	39	36	3
Other oaks	15	14	1
California laurel	23	12	11
Other hardwoods	83	34	49
Total	1,288	1,171	117
All species	19,137	15,907	3,230

[1] *Includes 30 million board feet of lodgepole pine.*

[2] *Primarily incense-cedar.*

Table 26. — Volume of growing stock on commercial forest land, by forest type and ownership class, Mendocino and Sonoma Counties, California, January 1, 1968

(In million cubic feet)

Forest type	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Douglas-fir	1,019	208	36	303	472
Redwood	1,918	---	222	896	800
True firs	141	134	---	---	7
Ponderosa pine	55	47	---	3	5
Bishop pine	65	---	---	---	65
Lodgepole pine	7	---	---	---	7
Incense-cedar	1	---	---	---	1
Red alder	13	1	---	7	5
California black oak	53	7	5	---	41
Oregon white oak	50	---	---	19	31
Pacific madrone	104	---	2	42	60
Tanoak	719	---	71	333	315
Other commercial hardwoods	134	4	24	29	77
Commercial nonstocked	7	---	---	1	6
All types	4,286	401	360	1,633	1,892

Table 27. — Volume of sawtimber on commercial forest land by forest type and ownership class, Mendocino and Sonoma Counties, California, January 1, 1968 (International 1/4-inch rule)

(In million board feet)

Forest type	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Douglas-fir	4,984	1,254	167	1,304	2,259
Redwood	8,969	---	1,121	4,113	3,735
True firs	721	697	---	---	24
Ponderosa pine	281	249	---	18	14
Bishop pine	270	---	---	---	270
Lodgepole pine	30	---	---	---	30
Incense-cedar	8	---	---	---	8
Red alder	52	13	---	27	12
California black oak	189	38	21	---	130
Oregon white oak	150	---	---	44	106
Pacific madrone	348	---	9	138	201
Tanoak	2,631	---	247	1,321	1,063
Other commercial hardwoods	480	6	83	122	269
Commercial nonstocked	24	---	---	---	24
All types	19,137	2,257	1,648	7,087	8,145

Table 28. — Volume of growing stock and sawtimber on commercial forest land, by forest type and county, Mendocino and Sonoma Counties, California, January 1, 1968

Forest type	Growing stock			Sawtimber		
	All counties	Mendocino County	Sonoma County	All counties	Mendocino County	Sonoma County
	Million cubic feet			*Million board feet, International 1/4-inch rule*		
Douglas-fir	1,019	788	231	4,984	3,893	1,091
Redwood	1,918	1,552	366	8,969	7,223	1,746
True firs	141	141	---	721	721	---
Ponderosa pine	55	55	---	281	281	---
Bishop pine	65	62	3	270	255	15
Lodgepole pine	7	7	---	30	30	---
Incense-cedar	1	1	---	8	8	---
Red alder	13	13	---	52	52	---
California black oak	53	50	3	189	181	8
Oregon white oak	50	41	9	150	117	33
Pacific madrone	104	94	10	348	316	32
Tanoak	719	675	44	2,631	2,431	200
Other commercial hardwoods	134	115	19	480	391	89
Commercial nonstocked	7	1	6	24	8	16
All types	4,286	3,595	691	19,137	15,907	3,230

Table 29. — Volume of growing stock on commercial forest land, by species and diameter class, Mendocino and Sonoma Counties, California, January 1, 1968

(In million cubic feet)

Species	Diameter class (inches at breast height)											
	All classes	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:												
Douglas-fir	1,273	14	33	35	54	74	78	95	94	255	237	304
Redwood	2,008	12	24	36	67	83	125	120	134	486	416	505
Grand fir	46	2	1	3	1	1	3	4	4	10	5	12
Red fir	13	---	---	---	---	---	---	---	---	4	2	7
White fir	105	1	2	4	5	6	6	8	7	30	29	7
Ponderosa pine	101	---	1	1	2	1	3	7	1	18	26	41
Sugar pine	29	---	---	---	---	---	2	1	---	3	9	14
Bishop pine[1]	37	---	---	2	6	5	4	1	1	14	4	---
Cedars[2]	11	---	1	1	1	---	---	---	1	1	4	2
Western hemlock	2	---	---	1	---	1	---	---	---	---	---	---
Total	3,625	29	62	83	136	171	221	236	242	821	732	892
Hardwoods:												
Red alder	20	1	3	2	2	3	4	3	1	1	---	---
Pacific madrone	99	8	8	11	11	12	8	11	6	15	5	4
Tanoak	354	23	39	40	37	41	42	30	22	56	20	4
California black oak	58	1	3	3	10	10	3	5	4	11	6	2
Canyon live oak	52	1	2	6	6	10	9	3	4	7	4	---
Oregon white oak	26	2	3	5	3	1	2	1	5	4	---	---
Other oaks	12	2	1	3	1	3	---	1	---	---	---	1
California laurel	17	3	4	3	1	1	1	1	1	1	1	---
Other hardwoods	23	---	1	1	3	4	3	2	2	5	2	---
Total	661	41	64	74	74	85	72	57	45	100	38	11
All species	4,286	70	126	157	210	256	293	293	287	921	770	903

[1] *Includes 7 million cubic feet of lodgepole pine.*

[2] *Primarily incense-cedar.*

Table 30. — Volume of sawtimber on commercial forest land, by species and diameter class, Mendocino and Sonoma Counties, California, January 1, 1968 (International ¼-inch rule)

(In million board feet)

Species	Diameter class (inches at breast height)								
	All classes	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:									
Douglas-fir	6,458	136	237	295	407	459	1,416	1,464	2,044
Redwood	9,573	142	326	573	570	664	2,506	2,136	2,656
Grand fir	202	5	3	5	18	20	49	31	71
White fir	524	20	25	28	37	40	165	170	39
Red fir	67	---	2	---	2	1	19	9	34
Ponderosa pine	620	6	5	11	27	6	104	167	294
Sugar pine	184	1	1	7	5	---	19	60	91
Bishop pine[1]	168	16	19	20	5	7	78	23	---
Cedars[2]	50	3	1	2	1	4	4	21	14
Western hemlock	3	---	3	---	---	---	---	---	---
Total	17,848	329	622	941	1,072	1,201	4,360	4,081	5,243
Hardwoods:									
Red alder	52	6	9	14	10	4	7	2	---
Pacific madrone	165	22	26	18	25	16	39	12	7
Tanoak	631	66	92	106	81	61	157	57	11
California black oak	144	20	22	7	12	12	34	29	8
Canyon live oak	136	13	25	27	9	15	30	17	---
Oregon white oak	39	8	2	4	3	12	10	---	---
Other oaks	15	1	6	---	4	---	---	---	4
California laurel	23	3	2	2	2	4	2	6	2
Other hardwoods	83	6	15	11	6	14	21	10	---
Total	1,288	145	199	189	152	138	300	133	32
All species	19,137	474	821	1,130	1,224	1,339	4,660	4,214	5,275

[1] *Includes 30 million board feet of lodgepole pine.*

[2] *Primarily incense-cedar.*

Table 31. — Net annual growth of growing stock and sawtimber on commercial forest land, by ownership class and softwoods and hardwoods, Mendocino and Sonoma Counties, California, 1967

Timber and ownership class	All species	Softwoods	Hardwoods
	Thousand cubic feet		
Growing stock:			
National Forest	640	490	150
Other public	9,600	7,700	1,900
Forest industry	41,320	31,990	9,330
Farmer and miscellaneous private	55,470	44,870	10,600
All ownerships	107,030	85,050	21,980
	Thousand board feet		
Sawtimber (International ¼-inch rule):			
National Forest	2,810	2,440	370
Other public	50,080	45,020	5,060
Forest industry	174,350	161,130	13,220
Farmer and miscellaneous private	271,680	247,280	24,400
All ownerships	498,920	455,870	43,050
Sawtimber (Scribner rule):			
National Forest	2,590	2,220	370
Other public	47,040	42,100	4,940
Forest industry	162,490	149,500	12,990
Farmer and miscellaneous private	253,480	229,790	23,690
All ownerships	465,600	423,610	41,990

Table 32. — Net annual growth of growing stock on commercial forest land, by species and ownership class, Mendocino and Sonoma Counties, California, 1967

(In thousand cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	26,450	[1] -430	1,630	11,730	13,520
Redwood	54,130	---	6,010	19,200	28,920
Grand fir	1,520	---	---	560	960
White fir	530	500	---	30	---
Red fir	60	60	---	---	---
Ponderosa pine	1,180	230	60	330	560
Sugar pine	10	10	---	([2])	---
Bishop pine[3]	860	---	---	---	860
Cedars[4]	130	120	---	---	10
Western hemlock	180	---	---	140	40
Total	85,050	490	7,700	31,990	44,870
Hardwoods:					
Red alder	540	20	20	460	40
Pacific madrone	3,250	---	420	1,140	1,690
Tanoak	13,760	---	1,130	6,670	5,960
California black oak	830	100	60	130	540
Canyon live oak	720	30	230	210	250
Oregon white oak	930	---	---	290	640
Other oaks	560	---	10	---	550
California laurel	640	---	10	80	550
Other hardwoods	750	---	20	350	380
Total	21,980	150	1,900	9,330	10,600
All species	107,030	640	9,600	41,320	55,470

[1] *Negative growth is the result of mortality exceeding gross annual growth.*

[2] *Less than 5,000 cubic feet.*

[3] *Includes lodgepole pine.*

[4] *Primarily incense-cedar.*

Table 33. — Net annual growth of sawtimber on commercial forest land, by species and ownership class, Mendocino and Sonoma Counties, California, 1967 (International 1/4-inch rule)

(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	131,340	[1] -2,480	9,700	54,740	69,380
Redwood	298,300	---	34,900	101,570	161,830
Grand fir	6,100	---	---	2,290	3,810
White fir	2,730	2,490	---	240	---
Red fir	320	320	---	---	---
Ponderosa pine	7,260	1,490	420	2,110	3,240
Sugar pine	90	70	---	20	---
Bishop pine[2]	8,930	---	---	---	8,930
Cedars[3]	640	550	---	---	90
Western hemlock	160	---	---	160	---
Total	455,870	2,440	45,020	161,130	247,280
Hardwoods:					
Red alder	1,670	70	100	1,030	470
Pacific madrone	10,170	---	1,570	1,440	7,160
Tanoak	21,060	---	2,220	9,370	9,470
California black oak	2,920	270	100	270	2,280
Canyon live oak	2,430	30	930	710	760
Oregon white oak	2,050	---	---	230	1,820
Other oaks	280	---	40	---	240
California laurel	380	---	---	30	350
Other hardwoods	2,090	---	100	140	1,850
Total	43,050	370	5,060	13,220	24,400
All species	498,920	2,810	50,080	174,350	271,680

[1] *Negative growth is the result of mortality exceeding gross annual growth.*

[2] *Includes lodgepole pine.*

[3] *Primarily incense-cedar.*

Table 34. — Net annual growth of sawtimber on commercial forest land, by species and ownership class, Mendocino and Sonoma Counties, California, 1967 (Scribner rule)

(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	121,600	[1] -2,350	9,180	50,410	64,360
Redwood	278,130	---	32,520	94,550	151,060
Grand fir	5,670	---	---	2,160	3,510
White fir	2,500	2,280	---	220	---
Red fir	300	300	---	---	---
Ponderosa pine	6,830	1,410	400	1,990	3,030
Sugar pine	90	70	---	20	---
Bishop pine[2]	7,750	---	---	---	7,750
Cedars[3]	590	510	---	---	80
Western hemlock	150	---	---	150	---
Total	423,610	2,220	42,100	149,500	229,790
Hardwoods:					
Red alder	1,640	70	100	1,000	470
Pacific madrone	9,880	---	1,520	1,420	6,940
Tanoak	20,550	---	2,170	9,200	9,180
California black oak	2,870	270	100	270	2,230
Canyon live oak	2,400	30	910	700	760
Oregon white oak	1,990	---	---	230	1,760
Other oaks	280	---	40	---	240
California laurel	370	---	---	30	340
Other hardwoods	2,010	---	100	140	1,770
Total	41,990	370	4,940	12,990	23,690
All species	465,600	2,590	47,040	162,490	253,480

[1] *Negative growth is the result of mortality exceeding gross annual growth.*

[2] *Includes lodgepole pine.*

[3] *Primarily incense-cedar.*

Table 35. — Net annual growth of growing stock and sawtimber on commercial forest land, by species and county, Mendocino and Sonoma Counties, California, 1967

Species	Growing stock			Sawtimber		
	All counties	Mendocino County	Sonoma County	All counties	Mendocino County	Sonoma County
	Thousand cubic feet			*Thousand board feet, International 1/4-inch rule*		
Softwoods:						
Douglas-fir	26,450	23,140	3,310	131,340	118,720	12,620
Redwood	54,130	42,000	12,130	298,300	225,680	72,620
Grand fir	1,520	1,410	110	6,100	5,860	240
White fir	530	530	---	2,730	2,730	---
Red fir	60	60	---	320	320	---
Ponderosa pine	1,180	1,180	---	7,260	7,260	---
Sugar pine	10	10	([3])	90	70	20
Bishop pine[1]	860	770	90	8,930	7,170	1,760
Cedars[2]	130	130	---	640	640	---
Western hemlock	180	180	---	160	160	---
Total	85,050	69,410	15,640	455,870	368,610	87,260
Hardwoods:						
Red alder	540	510	30	1,670	1,490	180
Pacific madrone	3,250	3,210	40	10,170	10,080	90
Tanoak	13,760	13,070	690	21,060	20,600	460
California black oak	830	980	[4] -150	2,920	3,250	[4] -330
Canyon live oak	720	710	10	2,430	2,370	60
Oregon white oak	930	860	70	2,050	2,000	50
Other oaks	560	680	[4] -120	280	250	30
California laurel	640	180	460	380	130	250
Other hardwoods	750	550	200	2,090	780	1,310
Total	21,980	20,750	1,230	43,050	40,950	2,100
All species	107,030	90,160	16,870	498,920	409,560	89,360

[1] *Includes lodgepole pine.*

[2] *Primarily incense-cedar.*

[3] *Less than 5,000 cubic feet.*

[4] *Negative growth is the result of mortality exceeding gross annual growth.*

Table 36. — Net annual growth of growing stock and sawtimber on commercial forest land, by forest type and county, Mendocino and Sonoma Counties, California, 1967

Forest type	Growing stock			Sawtimber		
	All counties	Mendocino County	Sonoma County	All counties	Mendocino County	Sonoma County
	- - - - Thousand cubic feet - - -			*Thousand board feet, International 1/4-inch rule*		
Douglas-fir	20,810	17,040	3,770	93,490	76,140	17,350
Redwood	52,560	41,460	11,100	280,270	217,120	63,150
True firs	870	870	---	3,370	3,370	---
Ponderosa pine	710	710	---	3,740	3,740	---
Bishop pine	1,780	1,650	130	10,970	9,980	990
Lodgepole pine	280	280	---	2,980	2,980	---
Incense-cedar	30	30	---	250	250	---
Red alder	320	320	---	1,440	1,440	---
California black oak	1,200	870	330	4,190	4,070	120
Oregon white oak	830	1,330	[1] -500	3,410	6,420	[1] -3,010
Pacific madrone	3,850	3,590	260	12,820	11,580	1,240
Tanoak	20,740	19,710	1,030	71,690	65,520	6,170
Other commercial hardwoods	2,780	2,260	520	9,650	6,690	2,960
Commercial nonstocked	270	40	230	650	260	390
All types	107,030	90,160	16,870	498,920	409,560	89,360

[1] *Negative growth is the result of mortality exceeding gross annual growth.*

Table 37. — Net annual growth of growing stock and sawtimber on commercial forest land, by stand age and by softwoods and hardwoods, Mendocino and Sonoma Counties, California, 1967[1]

Stand age (years)	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Thousand cubic feet			*Thousand board feet, International 1/4-inch rule*		
Nonstocked	270	180	90	650	430	220
0 - 9	5,070	3,160	1,910	16,190	13,770	2,420
10 - 19	3,840	2,540	1,300	10,720	10,330	390
20 - 29	1,560	1,490	70	5,520	5,400	120
30 - 39	9,190	7,900	1,290	45,700	42,050	3,650
40 - 49	10,300	8,970	1,330	60,250	56,400	3,850
50 - 59	13,320	11,840	1,480	63,330	58,000	5,330
60 - 69	11,600	10,060	1,540	66,650	61,870	4,780
70 - 79	5,940	5,390	550	31,490	30,540	950
80 - 89	2,350	2,090	260	14,030	13,330	700
90 - 99	770	70	700	1,460	470	990
100 - 119	1,300	1,020	280	6,840	6,010	830
120 - 139	190	180	10	1,200	1,140	60
140 - 159	320	210	110	1,510	1,300	210
160 - 179	630	320	310	2,560	1,700	860
180 - 199	---	---	---	---	---	---
200 and over	2,410	1,770	640	9,100	8,620	480
Uneven-aged under 100 years	31,390	22,790	8,600	134,690	120,270	14,420
Uneven-aged over 100 years	5,940	4,580	1,360	24,220	21,800	2,420
All ages	106,390	84,560	21,830	496,110	453,430	42,680

[1] *Due to lack of data, this table excludes growth on National Forest land.*

Table 38. — Average annual mortality of growing stock and sawtimber on commercial forest land, by softwoods and hardwoods and by cause of death, Mendocino and Sonoma Counties, California, 1963-67

Timber class	Cause of death					
	All causes	Fire	Insects	Disease	Other[1]	Miscellaneous and unknown
	Thousand cubic feet					
Growing stock:						
Softwoods	8,970	320	910	1,890	2,050	3,800
Hardwoods	1,040	290	---	190	430	130
Total	10,010	610	910	2,080	2,480	3,930
	Thousand board feet, International 1/4-inch rule					
Sawtimber:						
Softwoods	47,680	1,230	6,840	10,830	9,130	19,650
Hardwoods	1,690	460	---	470	760	---
Total	49,370	1,690	6,840	11,300	9,890	19,650
	Thousand board feet, Scribner rule					
Sawtimber:						
Softwoods	44,710	1,170	6,430	9,960	8,740	18,410
Hardwoods	1,650	450	---	470	730	---
Total	46,360	1,620	6,430	10,430	9,470	18,410

[1] *Largely weather killed, some of which had been predisposed to windthrow or windbreak by root rot and heart rot.*

Table 39. — Average annual mortality of growing stock on commercial forest land, by species and ownership class, Mendocino and Sonoma Counties, California, 1963-67

(In thousand cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	6,270	2,280	60	1,760	2,170
Redwood	620	---	---	260	360
True firs	1,490	1,490	---	---	---
Ponderosa pine	220	220	---	---	---
Sugar pine	230	230	---	---	---
Other softwoods	140	10	---	---	130
Total	8,970	4,230	60	2,020	2,660
Hardwoods:					
Red alder	130	---	---	---	130
Tanoak	470	---	---	320	150
California black oak	190	([1])	---	---	190
Other hardwoods	250	---	---	110	140
Total	1,040	---	---	430	610
All species	10,010	4,230	60	2,450	3,270

[1] *Less than 5,000 cubic feet.*

Table 40. — Average annual mortality of sawtimber on commercial forest land, by species and ownership class, Mendocino and Sonoma Counties, California, 1963-67 (International 1/4-inch rule)

(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	35,310	12,840	420	9,840	12,210
Redwood	950	---	---	950	---
True firs	8,360	8,360	---	---	---
Ponderosa pine	1,270	1,270	---	---	---
Sugar pine	1,300	1,300	---	---	---
Other softwoods	490	60	---	---	430
Total	47,680	23,830	420	10,790	12,640
Hardwoods:					
Red alder	---	---	---	---	---
Tanoak	890	---	---	440	450
California black oak	490	20	---	---	470
Other hardwoods	310	---	---	310	---
Total	1,690	20	---	750	920
All species	49,370	23,850	420	11,540	13,560

Table 41. — Average annual mortality of growing stock on commercial forest land, by forest type and ownership class, Mendocino and Sonoma Counties, California, 1963-67

(In thousand cubic feet)

Forest type	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Douglas-fir	4,180	2,280	60	610	1,230
Redwood	1,050	---	---	580	470
True firs	1,480	1,480	---	---	---
Pines	600	470	---	---	130
Other softwoods	---	---	---	---	---
Hardwoods	2,700	([1])	---	1,260	1,440
Nonstocked	---	---	---	---	---
All types	10,010	4,230	60	2,450	3,270

[1] *Less than 5,000 cubic feet.*

Table 42. — Average annual mortality of sawtimber on commercial forest land, by forest type and ownership class, Mendocino and Sonoma Counties, California, 1963-67 (International 1/4-inch rule)

(In thousand board feet)

Forest type	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Douglas-fir	20,270	12,830	420	1,770	5,250
Redwood	3,330	---	---	2,880	450
True firs	8,360	8,360	---	---	---
Pines	3,060	2,640	---	---	420
Other softwoods	---	---	---	---	---
Hardwoods	14,350	20	---	6,890	7,440
Nonstocked	---	---	---	---	---
All types	49,370	23,850	420	11,540	13,560

Table 43. — Average annual mortality of growing stock and sawtimber on commercial forest land by species and county, Mendocino and Sonoma Counties, California, 1963-67

Species	Growing stock			Sawtimber		
	All counties	Mendocino County	Sonoma County	All counties	Mendocino County	Sonoma County
	- - - Thousand cubic feet - - -			*Thousand board feet, International 1/4-inch rule*		
Softwoods:						
Douglas-fir	6,270	4,800	1,470	35,310	26,410	8,900
Redwood	620	420	200	950	950	---
True firs	1,490	1,490	---	8,360	8,360	---
Ponderosa pine	220	220	---	1,270	1,270	---
Sugar pine	230	230	---	1,300	1,300	---
Other softwoods	140	140	---	490	490	---
Total	8,970	7,300	1,670	47,680	38,780	8,900
Hardwoods:						
Red alder	130	130	---	---	---	---
Tanoak	470	150	320	890	450	440
California black oak	190	([1])	190	490	20	470
Other hardwoods	250	110	140	310	310	---
Total	1,040	390	650	1,690	780	910
All species	10,010	7,690	2,320	49,370	39,560	9,810

[1] *Less than 5,000 cubic feet.*

Table 44. — Net volume of salvable dead sawtimber on commercial forest land, by species and county, Mendocino and Sonoma Counties, California, January 1, 1968

Species	Growing stock			Sawtimber		
	All counties	Mendocino County	Sonoma County	All counties	Mendocino County	Sonoma County
	Thousand cubic feet			*Thousand board feet, International 1/4-inch rule*		
Douglas-fir	15,970	11,040	4,930	108,600	74,900	33,700
Redwood	2,580	1,730	850	12,310	7,600	4,710
Ponderosa pine	1,000	1,000	---	6,350	6,350	---
Bishop pine	630	630	---	1,860	1,860	---
Tanoak	1,000	1,000	---	2,460	2,460	---
Other hardwoods	720	720	---	2,070	2,070	---
All species	21,900	16,120	5,780	133,650	95,240	38,410

Table 45. — Net volume of salvable dead sawtimber on commercial forest land, by volume-per-acre class and by county, Mendocino and Sonoma Counties, California, January 1, 1968

Volume-per-acre class	All counties	Mendocino County	Sonoma County
	Thousand cubic feet		
Cubic feet:			
1 - 199	2,350	2,350	---
200 - 499	13,230	8,740	4,490
500 - 999	5,070	3,780	1,290
1,000 - 1,999	1,250	1,250	---
2,000 or more	---	---	---
All classes	21,900	16,120	5,780
	Thousand board feet, International ¼-inch rule		
Board feet:			
1 - 499	6,400	6,400	---
500 - 999	---	---	---
1,000 - 2,499	83,890	53,310	30,580
2,500 - 4,999	24,580	19,870	4,710
5,000 - 9,999	18,780	15,660	3,120
10,000 or more	---	---	---
All classes	133,650	95,240	38,410

Table 46. — Reported timber production, Mendocino and Sonoma Counties, California, 1947-69

(Million board feet)[1]

Year	Total	Mendocino County	Sonoma County
1947	232	211	21
1948	356	316	40
1949	413	365	48
1950	575	520	55
1951	830	753	77
1952	881	805	76
1953	1,011	927	84
1954	1,128	994	134
1955	1,243	1,030	213
1956	1,202	990	212
1957	1,000	792	208
1958	985	796	189
1959	880	623	257
1960	841	635	206
1961	824	683	141
1962	884	727	157
1963	785	634	151
1964	730	611	119
1965	657	540	117
1966	568	487	81
1967	552	493	59
1968	638	561	77
1969	603	525	78

Source: California Division of Forestry (1948-71).

[1] *Log rule unspecified.*

RELIABILITY OF CURRENT INVENTORY DATA

Forest Land Area and Timber Volume

The estimates of forest land area and timber volume in Mendocino and Sonoma Counties were derived by sampling and consequently have sampling errors. Sampling errors have been computed for the estimates of commercial forest land area, noncommercial forest land area, net cubic-foot volume of growing stock, and net board-foot volume (International 1/4-inch rule) of sawtimber. These are presented in table 47 as a percent of the estimated total at the 68-percent and 95-percent probability levels. They may be interpreted as meaning that the odds are two out of three for 68-percent probability or 19 out of 20 for 95-percent probability, that the ranges shown include the true value (i.e., the results of a 100-percent inventory). For example, if the statement is made that the total sawtimber volume which would result from a 100-percent cruise lies somewhere between 17,300 million board feet and 20,974 million board feet, the statement has 19 chances in 20 of being correct.

Table 47. — Sampling errors of estimates of forest area and timber volume

Item	Estimated total	Sampling error in percent	
		68-percent probability	95-percent probability
Commercial forest land	1,564,000 acres	± 1.9	± 3.7
Noncommercial forest land	723,000 acres	± 4.3	± 8.4
Volume:			
Growing stock	4,286 million cubic feet	± 4.4	± 8.6
Sawtimber (International ¼-inch rule)	19,137 million board feet	±4.9	± 9.6

In addition to measurable sampling errors, there may be other, nonsampling errors due to mistakes in judgment, measurement, and compilation. The magnitude of errors from these sources cannot be determined. However, such errors are kept to a minimum through training, supervision, field checking, and complete editing and machine verification in compiling the data.

The sampling error of any breakdown of these totals will be substantially greater than for the total. The smaller the breakdown, the larger the sampling error. An approximation of the increasing sampling error can be obtained from table 48, which shows the sampling error associated with smaller estimates.

Table 48. — Approximate sampling error by size of estimate

Commercial forest land		Growing stock		Sawtimber	
Area	Sampling error[1]	Volume	Sampling error[1]	Volume	Sampling error[1]
Thousand acres	*Percent*	*Million cubic feet*	*Percent*	*Million board feet, International 1/4-inch rule*	*Percent*
1,564	1.9	4,286	4.4	19,137	4.9
1,412	2.0	3,319	5.0	18,381	5.0
627	3.0	830	10.0	4,592	10.0
352	4.0	369	15.0	2,042	15.0
226	5.0	207	20.0	1,149	20.0
56	10.0	133	25.0	735	25.0
25	15.0	92	30.0	510	30.0
14	20.0	52	40.0	287	40.0
9	25.0	33	50.0	184	50.0
6	30.0	23	60.0	128	60.0
5	35.0	8	100.0	45	100.0
4	40.0				
3	45.0				
2	50.0				

[1] *By random sampling formula; 68-percent probability.*

FOREST SURVEY PROCEDURES

The data presented in this report are from three sources. The estimates for Mendocino National Forest within Mendocino County are based on a compilation — made by this Station — of plot data supplied by the Division of Timber Management, Region 5, of the U. S. Forest Service. These plot data were collected in the summers of 1962, 1963, and 1964 by Mendocino National Forest personnel. The field data for Sonoma County were collected in the summer of 1965 by the Forest Survey project of the Pacific Southwest Forest and Range Experiment Station. The field data for Mendocino County, other than National Forest, were collected in the summer of 1967 by the Forest Survey project, Pacific Northwest Forest and Range Experiment Station. A date of January 1, 1968, was selected to accommodate the largest and most dynamic segment of the inventory unit, Mendocino County. Although this date is given for all inventory data presented in this report, no updating was done to bring all data forward to this common date. However, the areas with older data — Sonoma County and National Forest lands in Mendocino County — likely experienced only nominal changes in their timber resources between time of data collection and January 1, 1968.

The same general standards and definitions were used for all the inventory projects for which data are brought together in this report. The same sampling design was used for all three projects.

A systematic grid of photo points was printed on a set of aerial photographs covering the entire survey unit. Each photo point was classified by major land use — commercial forest land, noncommercial forest land, and nonforest land — and ownership. The commercial forest land photo points were further classified into stand volume classes.

A stratified random sample of field plots, proportional to stratum area, was then selected from the photo points. This sample of photo points was visited in the field, and the accuracy of the photo classification of land use and ownership was checked. At each location falling on commercial forest land, an inventory plot was established.

The combined inventories for all owners in Mendocino and Sonoma Counties required classification of 11,726 photo points, establishment of 394 permanent plots on commercial forest land, and field checking on 377 sample locations on noncommercial and nonforest land.

National Forest Lands

The inventory plots established on National Forest land were 2/5-acre circular plots. Information on timber volume and forest conditions on these plots, expanded first to per-acre levels, then to stratum area levels, was the basis for estimates of live and dead timber volume, and the condition and characteristics of the forested area of Mendocino National Forest within Mendocino County. Growth and mortality estimates for this area were derived by applying growth and mortality rates, by species, to the timber volume estimates. These rates, supplied by Region 5 of the Forest Service, were derived from remeasurement of permanent growth and mortality plots on the west side of the Mendocino National Forest.

Lands Outside National Forests

On lands other than National Forests, each of the inventory plots consisted of 10 sample points distributed systematically over an acre. The variable-radius plot sampling principle was used at each sample point to select trees

to be tallied. The summation of the 10-point tally expressed the resources and conditions for the acre. Expansion of the acre samples to stratum area levels provided the inventory estimates of timber volume and forest conditions and characteristics.

These plots also provided data on growth and mortality. Increment cores were taken from trees on the field plots to determine radial growth; these increment data were used to develop multiple regression equations of diameter growth. The regression estimators were used to estimate the diameter of all trees tallied in the inventory 1 year prior to the base date of the inventory. Gross growth — for the year 1967 — is the difference between the net volumes computed for "past" and "present" diameters.

Annual mortality estimates were based on "postdating," or estimating the time of death of dead trees found on the plots. Former growing-stock trees estimated to have died within the 5 years preceding the date of inventory were tallied as "mortality."

DEFINITION OF TERMS

Land Area

Total Land Area

Includes dry land and land temporarily or partially covered by water, such as marshes, swamps, and river flood plains; streams, sloughs, and canals less than one-eighth mile wide; and lakes, reservoirs, and ponds less than 40 acres in area.

Forest Land Area

Land at least 16.7 percent stocked by trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Minimum area of forest land recognized is 1 acre.

Nonforest Land Area

Land that has never supported forests and land formerly forested where use for timber management is precluded by development for other uses. Included are areas used for agricultural crops, improved pasture, residential areas, city parks, improved roads of any width and right-of-way clearings, powerline clearings of any width, and 1 to 40 acres of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and other nonforest strips must be more than 120 feet wide, and clearings, etc., more than 1 acre in size, to qualify as nonforest land.

Forest Land Classes

Commercial Forest Land Area

Forest land which is producing or capable of producing industrial wood and not withdrawn from timber utilization.

Noncommercial Forest Land Area

Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions, and productive public forest land withdrawn from commercial timber use through statute or administrative regulation.

Productive reserved. — Public forest land withdrawn from timber utilization through statute, ordinance, or administrative order, but which otherwise qualifies as commercial forest land.

Unproductive. — Forest land incapable of yielding crops of industrial wood products (usually sawtimber) because of adverse site conditions, such as sterile soil, poor drainage, high elevation, steepness, and rockiness.

Forest Types

Forest types are determined on the basis of species plurality of all live trees that contribute to stocking, considering both size and spacing.

Tree Classes

Growing-stock Trees

Sawtimber trees, poletimber trees, saplings and seedlings; that is, all live trees except cull trees.

Sawtimber trees (11.0-inch d.b.h. and larger). — Live trees of commercial species that contain at least one 12-foot softwood saw log with a top diameter not less than 6 inches inside bark, or one 8-foot hardwood saw log with a top diameter not less than 8 inches inside bark. At least 25 percent of the

board-foot volume in the sawtimber trees must be free of defect.

Poletimber trees (5.0- to 10.9-inch d.b.h.). — Live trees of commercial species not less than 50 percent sound on a cubic-foot basis and with no disease, defects, or deformities which are likely to prevent them from becoming growing-stock sawtimber trees.

Sapling and seedling trees (less than 5.0-inch d.b.h.). — Live trees of commercial species with no disease, defects, or deformities which are likely to prevent them from becoming growing-stock poletimber trees.

Nongrowing-stock Trees

Cull trees. — Trees of noncommercial species and trees of commercial species which are too defective or which are unlikely to become growing-stock trees due to deformity, disease, low vigor, etc.

Sound cull trees. — Trees of noncommercial species, or with excessive defect due to form, roughness, etc.

Rotten cull trees. — Trees with excessive defect due primarily to rot.

Mortality trees. — Trees of commercial species which died from natural causes and which were not cull trees at the time of death.

Salvable dead trees. — Standing or down dead trees of commercial species 11.0 inches or more in diameter that contain 25 percent or more of sound volume and at least one merchantable 16-foot softwood or 8-foot hardwood saw log.

Stand-size Classes

Sawtimber Stand

Stand at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber and poletimber trees, and with sawtimber stocking equal to or greater than poletimber stocking.

Large sawtimber stand. — Stand in which the majority of the sawtimber stocking is in trees 21.0-inch d.b.h. and larger.

Small sawtimber stand. — Stand in which the majority of the sawtimber stocking is in trees from 11.0 to 20.9-inch d.b.h.

Poletimber Stand

Stand at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber and poletimber trees, and with poletimber stocking exceeding sawtimber stocking.

Sapling and Seedling Stand

Stand at least 16.7 percent stocked with growing-stock trees, with more than half of this stocking in saplings and/or seedlings.

Nonstocked Area

An area of commercial forest land less than 16.7 percent stocked with growing-stock trees.

Stocking

Stocking is a means of expressing the extent to which growing space is effectively utilized by present or potential growing-stock trees of commercial species. "Percent of stocking" is synonymous with "percentage or growing space occupied" and means the ratio of actual stocking to full stocking for comparable sites and stands. Basal area is used as a basis for measuring stocking.

"Stocking percentages" express current area occupancy in relation to specified standards for full stocking based on number, size, and spacing of trees considered necessary to fully utilize the forest land.

Full utilization of the site is assumed to occur over a range of basal area. As an interim guide, 60 percent of the normal yield table values has been used to establish the lower limit of this range which represents full site occupancy. This is called 100-percent stocking. The upper limit to full stocking has been set at 132 percent. Sites with less than 100-percent stocking represent understocking with less than full site occupancy. Overstocking is characterized by sites that have over 132-percent stocking.

Age

Stand Age

Stand age is based upon growing-stock

stocking. In order for a stand to be even-aged, a majority of the growing-stock stocking must be in two adjacent age classes. Stands that do not meet this criterion are classified as uneven-aged.

Old-growth Sawtimber Stand

Sawtimber stand in which 50 percent or more of the growing-stock stocking is in trees at least 100 years old.

Young-growth Sawtimber Stand

Sawtimber stand in which more than 50 percent of the growing-stock stocking is in trees less than 100 years old.

Timber Volume

Live Sawtimber Volume

Net volume in board feet of live sawtimber trees of commercial species. Net volume equals gross volume less deduction for rot, sweep, crook, and other defects that affect use for lumber.

Scribner rule. — The common board-foot log rule used in determining volume of sawtimber in California. Scribner volume in Mendocino and Sonoma Counties was measured in terms of 16-foot logs.

International 1/4-inch rule. — The standard board-foot log rule adopted nationally by the Forest Service for the presentation of Forest Survey volume statistics.

Saw-log portion. — That part of the bole of sawtimber trees between the stump and the saw-log top.

Upper stem portion. — That part of the bole of sawtimber trees above the saw-log top to a minimum top diameter of 4 inches outside bark or to the point where the central stem breaks into limbs.

Growing-stock Volume

Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4.0-inch top (of central stem) outside bark. Net volume equals gross volume less deduction for rot and missing bole sections.

All Timber Volume

Net volume in cubic feet of live and salvable dead sawtimber trees and poletimber trees of commercial species, and cull trees of all species, from stump to a minimum 4.0-inch top outside bark.

Industrial Wood

All roundwood products, except fuelwood.

Net Annual Growth

The increase in volume of a specified size class for a specific year. (Components of net annual growth include the increment in net volume of trees at the beginning of the specific year surviving to the year's end, plus volume of trees reaching the size class during the year, minus the volume of trees that died during the year, minus the net volume of trees that became culls during the year.)

Ownership Classes

National Forest Lands

Federal lands which have been designated by Executive order or statute as National Forests or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones title III lands.

Other Public Lands

Federal lands other than National Forests, including lands administered by the Bureau of Land Management, Bureau of Indian Affairs, and miscellaneous Federal agencies; and lands owned by States, counties, and local public agencies, including lands leased by these governmental units for more than 50 years.

Forest Industry Lands

Lands owned by companies or individuals operating wood-using plants.

Farmer-owned Lands

Lands owned by operators of farms.

Miscellaneous Private Lands

Privately owned lands other than forest industry or farmer-owned lands.

TREE SPECIES

Principal tree species found on the commercial forest land in Mendocino and Sonoma Counties include:

Softwoods:
California red fir *(Abies magnifica* var. *magnifica)*
Douglas-fir *(Pseudotsuga menziesii)*
Grand fir *(Abies grandis)*
Incense-cedar *(Libocedrus decurrens)*
Jeffrey pine *(Pinus jeffreyi)*
Knobcone pine *(Pinus attenuata)*
Ponderosa pine *(Pinus ponderosa)*
Lodgepole pine *(Pinus contorta)*
Bishop pine *(Pinus muricata)*
Redwood *(Sequoia sempervirens)*
Sitka spruce *(Picea sitchensis)*
Sugar pine *(Pinus lambertiana)*
Western hemlock *(Tsuga heterophylla)*
Western redcedar *(Thuja plicata)*
White fir *(Abies concolor)*

Hardwoods:
Bigleaf maple *(Acer macrophyllum)*
California black oak *(Quercus kelloggii)*
California-laurel *(Umbellularia californica)*
California live oak *(Quercus agrifolia)*
California white oak *(Quercus lobata)*
Canyon live oak *(Quercus chrysolepis)*
Eucalyptus *(Eucalyptus* spp.)
Golden chinkapin *(Castanopsis chrysophylla)*
Interior live oak *(Quercus wislizenii)*
Oregon white oak *(Quercus garryana)*
Pacific madrone *(Arbutus menziesii)*
Red alder *(Alnus rubra)*
Tanoak *(Lithocarpus densiflorus)*
White alder *(Alnus rhombifolia)*

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This report presents the findings of the first complete inventory of the timber resources of Mendocino and Sonoma Counties, California. Accompanying the tables of detailed forest area, volume, growth, and mortality statistics is an analysis of the present timber resource, with emphasis on conditions that affect present and future timber production.

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USDA Forest Service
Resource Bulletin PNW-41

June 1972

1971 WASHINGTON TIMBER HARVEST

by
Brian R. Wall, *Associate Economist*

Washington's 1971 timber harvest of 6.45 billion board feet was nearly the same as the 1970 harvest level. The total timber harvest on public lands increased nearly 4 percent with a 30-percent increase in eastern Washington more than offsetting a 5-percent decline in western Washington. Part of the increase in eastern Washington reflects salvage of a large volume of timber killed by fire in 1970. State lands in the State of Washington increased their production by 120 million board feet (up 20 percent). Other Federal Agencies had a sharp 51-million-board-foot increase in production, and Indian lands had a 48-million-board-foot increase (up 13 percent). Log production on the National Forests decline 117 million board feet (down 8 percent), and "other public" harvests declined 12 million board feet (down 30 percent).

The total 1971 private timber harvest declined 99 million board feet (down 2 percent) from that recorded in 1970. The "other private" (nonindustrial) timberlands led the decline with an 84-million-board-foot drop (down 12 percent) and log production on industrial lands declined 15 million board feet.

In 1971, average annual stumpage prices on publicly owned or managed lands declined 12 percent in western Washington even though prices strengthened in the fourth quarter. In eastern Washington, public stumpage prices dropped 17 percent. The volume of public timber sold in the State declined 247 million board feet (down 10 percent). The total uncut volume under contract on State, Bureau of Land Management, and National Forest lands rose 3 percent to 5,122 million board feet by yearend 1971.

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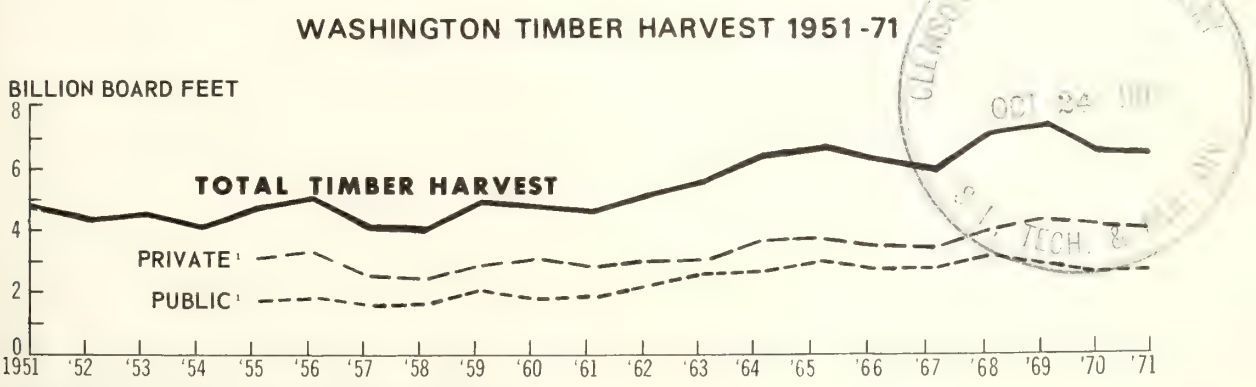


¹Separate data for public and private not available prior to 1955.

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION

Robert E. Buckman, *Director*
FOREST SERVICE

Portland, Oregon
U.S. Department of Agriculture

Timber Harvest by Ownership in State of Washington, 1971 [1/]

(In thousands of board feet, Scribner log scale)

Half-State and county	Private [2/]						State [2/]		Bureau of Land Management [4/]		National Forests [4/]		Indian lands [4/]		Other public [2/]		Other Federal [2/5/]		Total production
	Industrial		Other		Total private														
	Live	Dead [3/]	Live	Dead [3/]	Live	Dead [3/]	Live	Dead [3/]	Live	Dead [3/]	Live	Dead [3/]	Live	Dead [3/]	Live	Dead [3/]	Live	Dead [3/]	
Western Washington:																			
Clallam	144,899	200	30,174	195	175,073	395	65,645	545	--	--	65,274	6,438	12,299	--	162	--	--	--	325,831
Clark	24,508	--	14,314	20	38,822	20	12,001	535	--	--	--	--	--	--	670	--	62	--	52,110
Cowlitz	611,658	1	28,194	--	639,852	1	80,693	49	--	--	115	301	--	--	21	--	400	--	721,432
Grays Harbor	224,328	610	40,345	157	264,673	767	10,782	105	--	--	74,337	6,443	108,877	--	16,358	67	--	--	482,409
Island	6,020	--	6,447	--	12,467	--	--	15	--	--	--	--	--	--	95	--	--	--	12,577
Jefferson	106,732	1,701	32,446	200	139,178	1,901	251,157	2,159	--	--	39,492	4,891	--	--	161	--	748	--	439,687
King	270,292	--	71,677	--	341,969	--	14,400	99	546	--	55,228	2,573	241	--	670	--	659	--	416,385
Kitsap	5,986	--	14,478	--	20,464	--	4,696	--	--	--	--	--	618	193	952	--	250	--	27,173
Lewis	509,433	373	44,893	124	554,326	497	17,510	165	--	--	86,708	4,164	--	--	9	475	2,606	--	666,460
Mason	44,656	--	23,244	--	67,900	--	9,554	--	--	--	73,783	3,801	662	--	24	--	--	--	155,724
Pacific	527,600	190	7,310	50	534,910	240	20,632	--	--	--	--	--	--	--	--	--	1,025	--	556,807
Pierce	251,276	--	39,804	--	291,080	--	14,112	--	--	--	41,388	4,483	--	--	497	--	24,041	381	375,982
San Juan	1,169	--	529	--	1,698	--	--	--	--	--	--	--	--	--	--	--	--	--	1,698
Skagit	147,441	--	15,158	840	162,599	840	41,629	90	--	--	49,661	4,771	--	--	--	--	1,281	--	260,871
Skamania	20,565	--	57,443	--	78,008	--	6,530	350	338	--	201,524	65,544	--	--	--	--	1,105	--	353,399
Snohomish	69,790	--	40,604	107	110,354	107	25,462	15	--	--	47,297	5,557	--	--	170	--	30,000	--	218,962
Thurston	43,388	--	29,615	--	73,003	--	11,164	38	--	--	--	--	--	--	225	--	4,247	--	88,677
Wahkiakum	83,062	--	3,259	10	86,321	10	7,866	--	--	--	--	--	--	--	2,109	--	852	--	97,158
Whatcom	53,801	--	14,148	--	67,949	--	27,295	65	--	--	28,290	3,407	--	--	--	--	70	--	127,076
Total	3,146,564	3,075	514,082	1,703	3,660,646	4,778	621,128	4,230	884	--	763,097	112,373	122,697	193	22,123	542	67,346	381	5,380,418
Total live and dead	3,149,639		515,785		3,665,424		625,358		884		875,470		122,890		22,665		67,727		5,380,418
Eastern Washington:																			
Adams	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Asotin	--	--	6,250	--	6,250	--	--	--	--	--	1,325	45	--	--	--	--	--	--	7,620
Benton	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chelan	8,041	--	1,444	--	9,485	--	6,187	--	--	--	31,231	34,649	--	--	264	--	--	--	81,816
Columbia	1,013	--	2,077	--	3,090	--	--	--	--	--	8,795	102	--	--	--	--	--	--	11,987
Douglas	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ferry	18,664	--	1,017	--	19,681	--	6,674	--	1,272	--	20,194	--	72,074	--	--	--	--	--	119,895
Franklin	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Garfield	--	--	--	--	--	--	670	--	--	--	6,615	222	--	--	--	--	--	--	7,507
Grant	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kittitas	46,625	--	7,593	--	54,218	--	3,393	--	--	--	43,188	2,326	--	--	--	1,591	--	--	104,716
Klickitat	59,843	--	8,272	--	68,115	--	26,435	3,096	--	--	--	100	10,425	--	--	--	--	--	108,171
Lincoln	--	--	4,992	--	4,992	--	490	--	--	--	--	--	--	--	--	--	--	--	5,482
Okanogan	3,280	--	9,849	--	13,129	--	36,134	--	7	--	62,610	14,465	43,016	--	--	100	--	--	169,461
Pend Oreille	17,124	--	9,325	--	26,449	--	670	22	--	--	77,400	--	--	--	--	--	180	--	104,721
Spokane	860	--	13,998	--	14,858	--	--	--	--	--	--	--	--	--	601	--	210	--	15,669
Stevens	26,190	--	28,836	1,472	55,026	1,472	9,291	26	1,830	--	12,187	--	20,040	--	--	--	4,748	--	104,620
Walla Walla	--	--	1,866	--	1,866	--	460	--	--	--	--	--	--	--	--	--	--	--	2,326
Whitman	--	--	55	--	55	--	--	--	--	--	--	--	--	--	--	--	--	--	55
Yakima	1,660	--	312	--	1,972	--	2,813	196	--	--	69,820	693	146,343	1,155	3,074	--	--	--	226,066
Total	183,300	--	95,886	1,472	279,186	1,472	93,217	3,340	3,109	--	333,365	52,602	291,898	1,155	3,939	1,691	5,138	--	1,070,112
Total live and dead	183,300		97,358		280,658		96,557		3,109		385,967		293,053		5,630		5,138		1,070,112
Total Washington	3,329,864	3,075	609,968	3,175	3,939,832	6,250	714,345	7,570	3,993	--	1,096,462	164,975	414,595	1,348	26,062	2,233	72,484	381	
Total live and dead	3,332,939		613,143		3,946,082		721,915		3,993		1,261,437		415,943		28,295		72,865		6,450,530

1/ Includes volume in logs, poles, piling, shingle bolts, etc.

2/ Compiled by the Washington State Department of Natural Resources.

3/ Includes snags and down material existing prior to initial logging.

4/ Compiled by respective agencies, U.S. Bureau of Land Management, U.S. Forest Service, U.S. Bureau of Indian Affairs.

5/ Includes lands logged under jurisdiction of U.S. Department of Interior--Bonneville Power Administration, National Park Service, Bureau of Sport Fisheries and Wildlife; and U.S. Department of the Army.

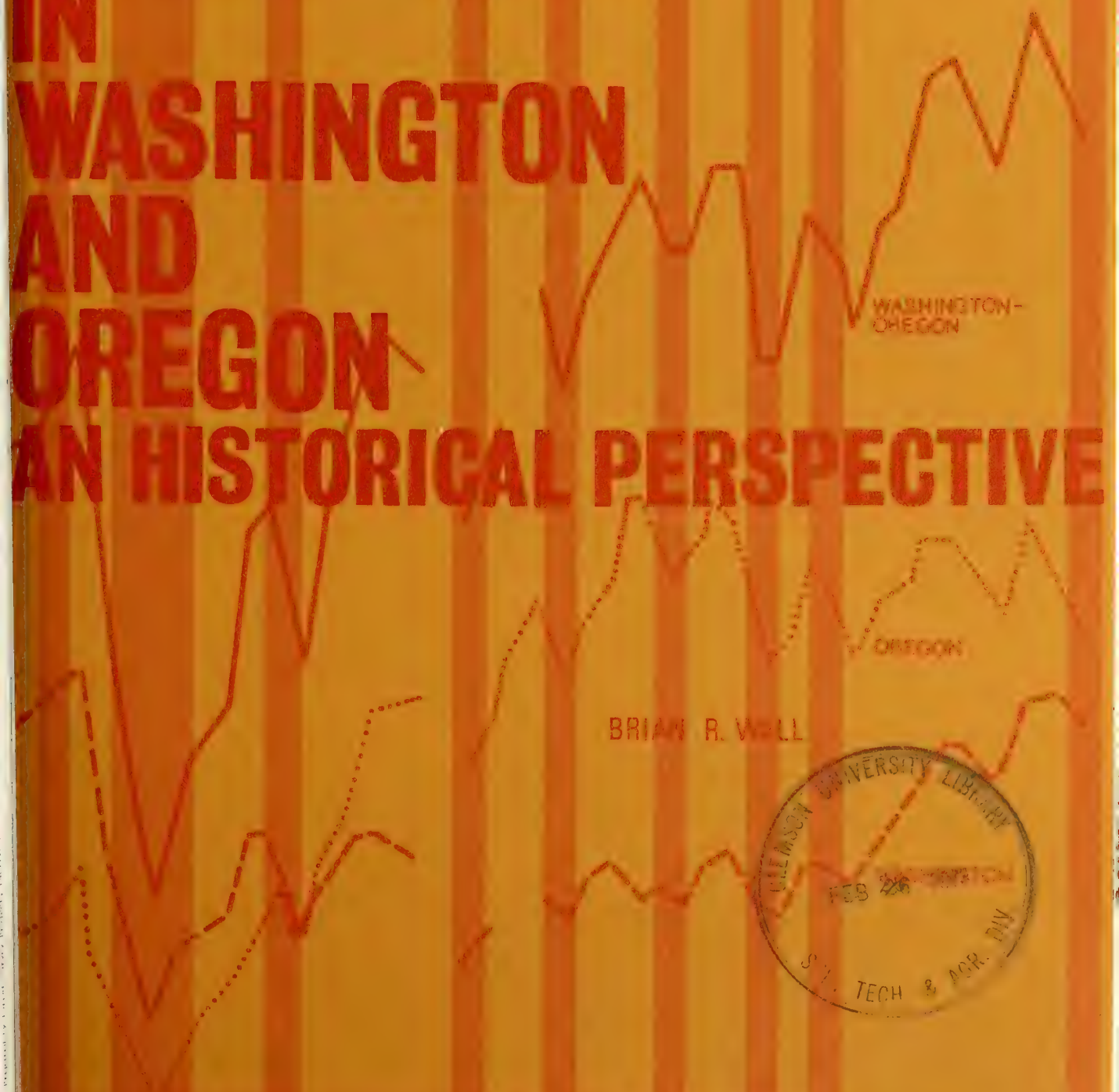
Prepared by Forest Survey Project, Pacific Northwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture, Portland, Oregon.

GPO 985-910

USDA FOREST SERVICE RESOURCE BULLETIN PNW-42
1972

LOG PRODUCTION IN WASHINGTON AND OREGON

AN HISTORICAL PERSPECTIVE



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PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
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ABSTRACT

In the history of the Pacific Northwest, log production and conversion have been major economic activities. The long-term trends in timber harvesting have been upward, and most of the harvest has come from large old-growth forest inventories. National and international demands for timber have been a major element in putting upward pressure on log production levels. Economic factors and timber characteristics have largely determined the location and magnitude of the timber harvest. In later years, landowner decisions regarding timber inventory levels and the rate of timber inventory reduction have constrained or reversed log production trends in local areas. As economic conditions have changed a broader spectrum of species has been included in the timber harvests.

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INTRODUCTION

The Pacific Northwest Forest and Range Experiment Station has collected and published log production data for many years. These data have been of interest to foresters, resource analysts, economists, business and Government leaders, legislators, and the academic community. The last comprehensive historical log production data compilation series for Oregon and Washington was published in 1950, covering the period 1925-48 (Moravets 1950). This study updates that report, presenting data by county for 1925-70 and by county and ownership class for the 1949-70 period (see Appendix, tables 1-54).

The log volume data are expressed in International 1/4-inch scale to facilitate comparison with national timber cut and forest inventory data.

The commentary and the graphics will assist the reader in relating log production to business conditions over time. The relationships presented will be of assistance to those who would like to pursue further research employing these data.

LOG PRODUCTION TRENDS

Oregon and Washington combined produce about one-quarter of the Nation's domestic roundwood. In 1970, total log production for the two States amounted to 16.9 billion board feet (International 1/4-inch scale). The two States reached a combined record annual timber harvest of 19.5 billion board feet in 1968. As shown in figure 1, the long-term trend in timber harvest for the Pacific Northwest has been a rising one since the mid-1800's even though there have been some sharp fluctuations.

The shaded areas shown on figure 1 and other figures in this report represent the contraction periods in the business economy of the United States as defined by the National Bureau of Economic Research. The unshaded areas are national expansion periods. The shaded areas begin with a business peak and end with a business trough.

As the United States population grew and the economy expanded, the timber inventories in the South and Lake States dwindled as lumber was produced for construction. The Pacific Northwest with its large inventories of old-growth timber became a major attraction to the timber industry around the turn of the century. As a result, Washington State led the Nation in log production by the early 1900's. Oregon's log production was lower, but roughly paralleled Washington's until about 1940 when a rapid 12-year rise in production began. In 1938, Oregon became the Nation's leading wood producer.

Oregon's rise to production dominance was the next major step in the history of the migrating timber industry as it moved to new areas for timber supplies. As of the 1930's, large areas of Washington State's private commercial forest lands had been cut over. As business picked up following the depression, investments in new sawmills and plywood plants were made further south

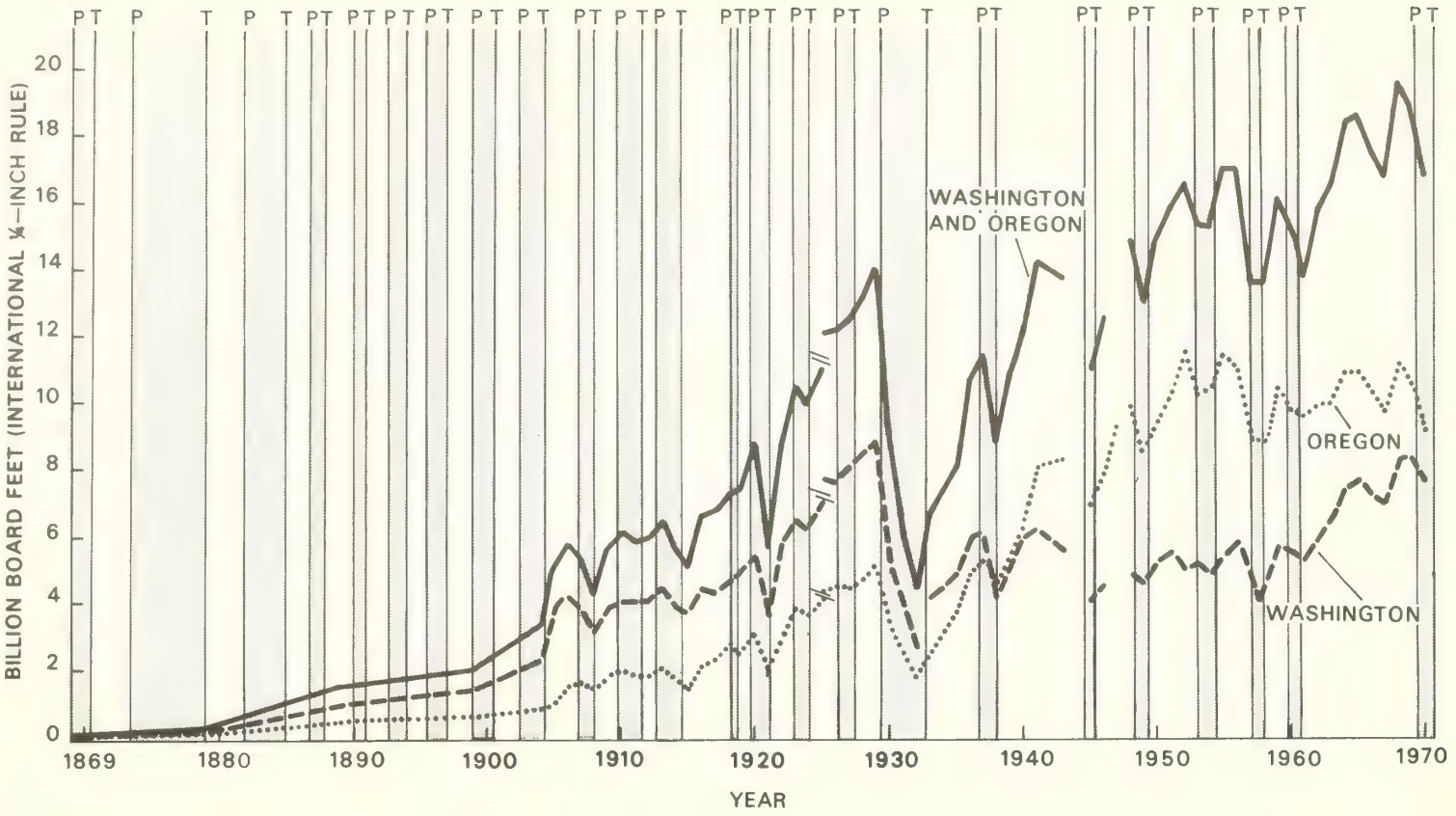

Figure 1.—Log production in Oregon and Washington, 1869-1970 (1869-1925 data based on lumber production).

in Oregon where large old-growth timber was more abundant and available, especially on the private lands (Andrews and Cowlin 1940). During the business recoveries after World War II, low private timber inventory of desirable species, inaccessible and unavailable timber, and old manufacturing facilities further constrained Washington's output whereas Oregon's output continued to increase. However, in the 1960's, availability of second-growth timber inventories as well as old-growth inventories of selected species on private lands in Washington had a positive influence on that State's timber production relative to Oregon. Despite increasing second-growth production, old growth still dominated the public and private log harvests in both States in 1970.

The movement of the geographical centers of log production in both the Douglas-fir and the ponderosa pine regions is portrayed in figure 2. This figure was developed from a "center of gravity" concept derived from the county of log origin.

The most significant movement occurred during the 1925-50 period as the Douglas-fir production center moved south from midwestern Washington to midwestern Oregon. Then during the 1950-69 period, the direction was reversed and the center moved toward northwestern Oregon. This northward movement was especially strong in the 1960's, reflecting the increasing timber harvests in western Washington.

The same type of graphic portrait in the ponderosa pine region produced results which were not so spectacular, for eastern Oregon has remained the geographic production center. Part of this is because eastern Oregon is the major wood producer in the ponderosa pine region, part is due to only slight movement of the eastern Washington geographical center, and part is due to the unequal geographic distribution of the forest land which does not lend itself easily to this kind of analysis. Nevertheless, the north and eastward movement of the production center does indicate the growing relative importance of log production in the Blue Mountains of eastern Oregon during the 1940-65 period. The increasing timber harvests on the Indian lands in eastern Washington and on the National Forests in eastern Washington and the Blue Mountains are also important influences on this trend.

DOUGLAS-FIR REGION LOG PRODUCTION

Log production in the Douglas-fir region has been generally increasing as shown in figure 3. This region, which includes that portion of Oregon and Washington west of the crest of the Cascades, accounts for the largest share (83 percent in 1970) of the timber harvest in the two States. Douglas-fir region log production generally increased from the time the timber industry became established through 1929 when 12.42 billion board feet of timber was harvested. Log production declined sharply during the depression and bottomed in 1932 when only 3.76 billion board feet were produced. Since then, the trend in production has been upward. In 1968, log production peaked at 16.20 billion board feet, but in the recession year of 1970, only 14.1 billion board feet of timber were harvested.

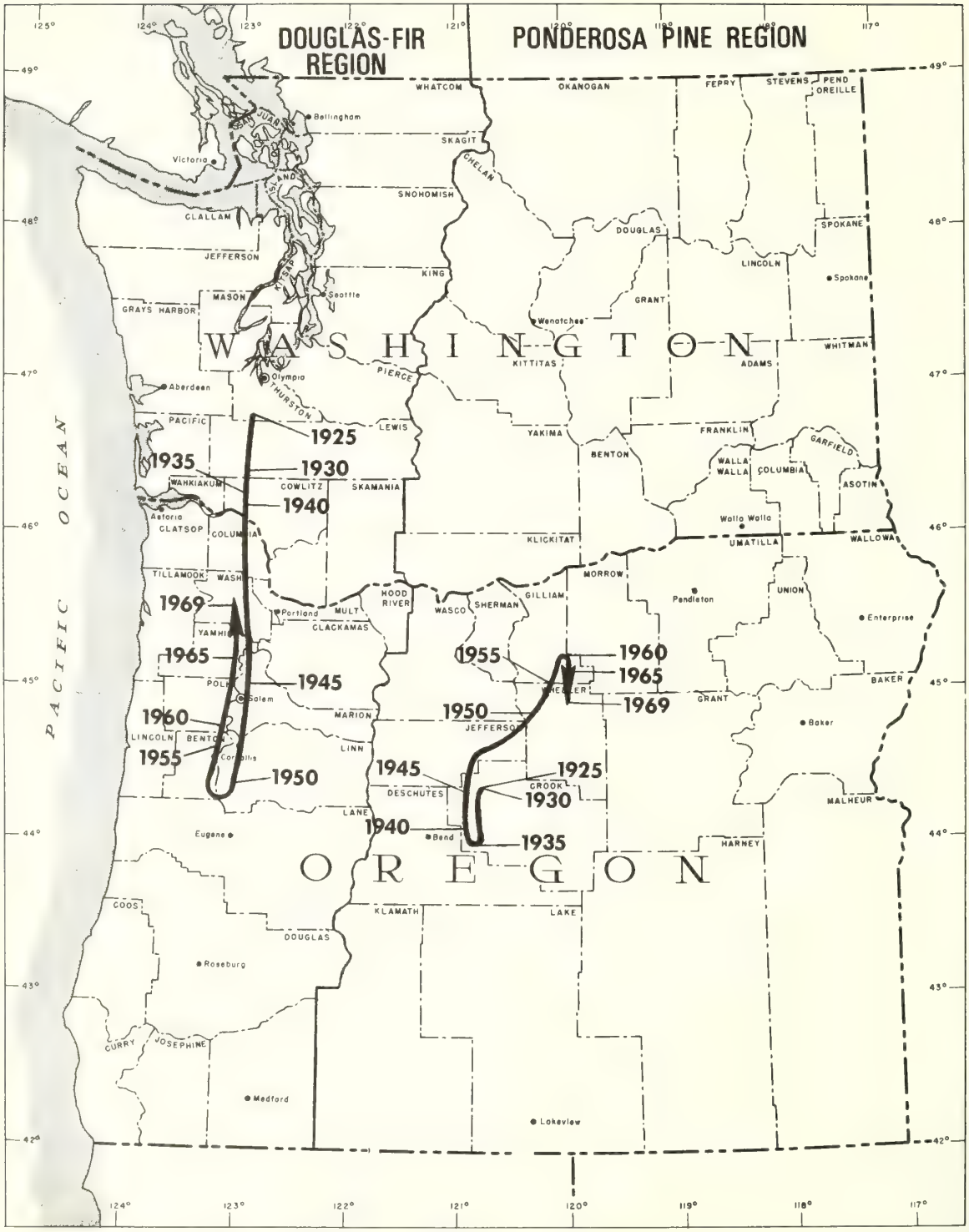

Figure 2.—Movement of the geographic centers of log production in the Pacific Northwest.

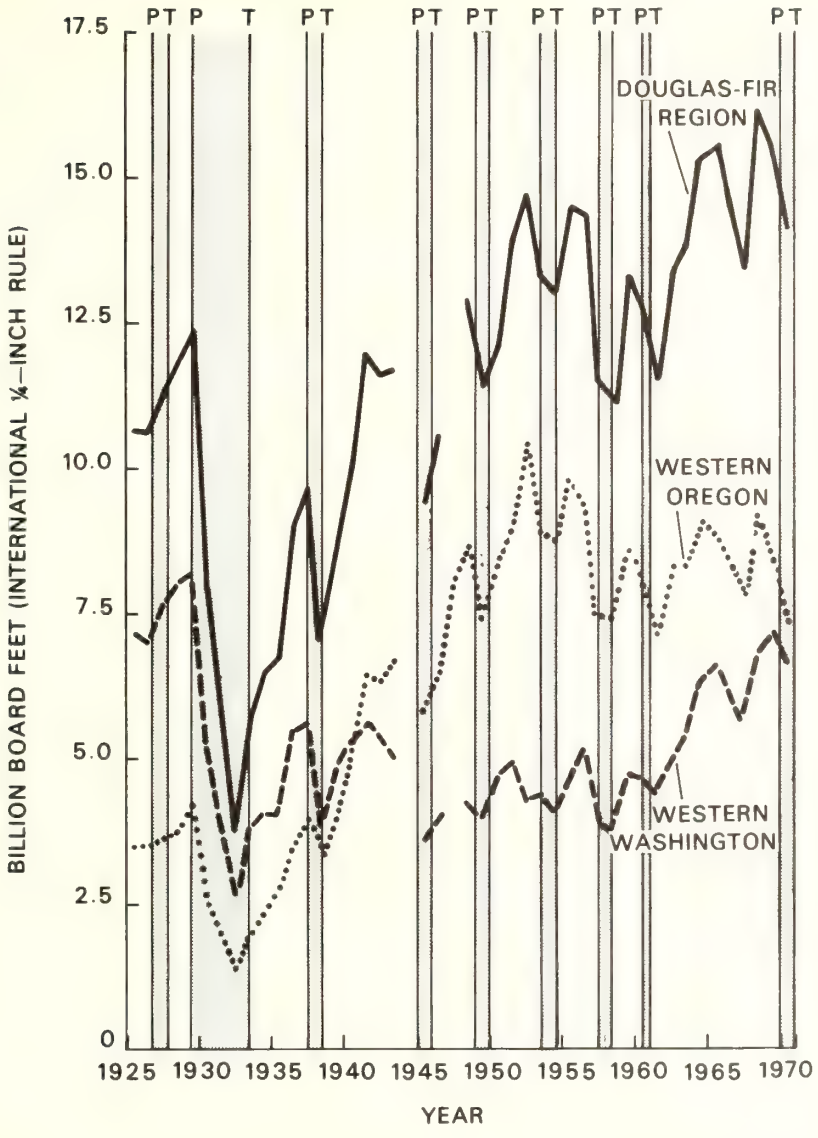

Figure 3.—Log production in the Douglas-fir region of Washington and Oregon, 1925-43, 1945-46, and 1948-70.

Western Washington's Log Production Peaked in 1929

The most important areas in terms of timber production have changed over time. Western Washington led the Pacific Northwest in timber production until the early 1940's, but its production peaked in 1929 at 8.24 billion board feet. After this, production dropped to 2.47 billion board feet in 1932, recovered somewhat in the mid-1930's, and then generally ranged between 4 and 5 billion board feet until the early 1960's. The harvest increased from 4.39 billion board feet in 1961 to 6.72 billion board feet in 1970 (fig. 3).

Within western Washington, the areas of principal logging activity have changed over the years. Magnificent forests of old-growth Douglas-fir and redcedar, along with ease of logging and transportation in the Puget Sound, Grays Harbor, and Willapa Bay areas, were major attractions to lumbermen in the 19th century (Andrews and Cowlin 1940). These were the major log producing areas for many years; and when the western Washington log production peak was reached in 1929, Grays Harbor County was the leading log producer in the Pacific Northwest with a timber harvest of 2.1 billion board feet. That same year, Clallam County ranked second with a harvest of 791 million board feet, followed by King County on Puget Sound with 726 million board feet. As of 1940, Andrews and Cowlin described the forestry scene after years of cutting as follows:

> Now western Washington particularly in the vicinity of Puget Sound and Grays Harbor is characterized by vast expanses of cutover land largely barren of conifer growth. The remaining old-growth Douglas-fir stands in western Washington are principally in the eastern parts of Cowlitz and Lewis Counties. Extensive virgin forests of western hemlock, Sitka spruce, and western redcedar occur along the Washington Coast, and on the upper slopes of the Cascade Range throughout western Washington occur extensive bodies of old-growth western hemlock and balsam fir-mountain hemlock.

Predictably, under such a timber inventory situation in western Washington, the industry moved closer to the remaining old-growth stands, the species mix of the timber harvest was broadened, and the harvest levels were reduced. As of 1970, western Washington counties continued to produce large amounts of timber, but they no longer were the region's leaders. Lewis County, which had long been a major timber supplier, led the western Washington cut in 1970 with 893 million board feet. Cowlitz County ranked second with 759 million board feet. Pacific and Grays Harbor Counties in the productive coastal area of southwest Washington were rising in importance and ranked third and fourth, respectively.

Western Oregon's Log Production Peaked in 1952

Western Oregon's log production generally increased in the early 1900's with a temporary peak in 1929 at 4.18 billion board feet. Like western Washington's pattern, log production in western Oregon dropped sharply during the depression and in 1932 only 1.29 billion board feet was harvested. As economic conditions improved in the 1930's, western Oregon's log production increased, and in 1941 it surpassed western Washington's cut. The upward trend culminated in 1952 to an alltime production peak of 10.40 billion board feet. During the mid-1950's and through 1961, the trend in western Oregon log production was down, reflecting the effects of two recessions as well as timber supply constraints. During most of the 1960's when the national economy was expanding, production fluctuated around a level trend line. In the recession year of 1970, log production in western Oregon amounted to 7.33 billion board

feet. This was the lowest timber harvest level since the recession year of 1961. Production for the decade of the 1960's peaked in 1968 but then dropped 13 percent between 1969 and 1970. Most of the decline occurred on the public lands and on the nonindustrial private lands (Wall 1971a).

Early timber harvesting in western Oregon occurred mainly in the counties along the Columbia River. In the 1920's, Clatsop and Columbia Counties led the State of Oregon in log production; and as the logging business peaked in 1929, these two counties produced 660 million board feet and 592 million board feet, respectively. Timber production dropped sharply in these counties during the depression, and an era of old-growth logging ended for much of northwestern Oregon. When business was to recover in the 1930's, timber supply factors would dictate the southward migration of the industry within western Oregon. Andrews and Cowlin described the timber situation at the close of the 1930's as follows:

> Logging has removed the virgin timber from extensive areas in extreme northwestern Oregon, but almost unbroken stands of old-growth Douglas-fir cover the lower slopes and foothills of the Cascade Range practically the length of the State. Scattered throughout this timber belt are comparatively small bodies of second growth and old burns, small deforested areas, and cut-over areas. At higher elevations, reaching to the summit of the Cascade Range, is a mixture of western hemlock, balsam fir-mountain hemlock, noncommercial forests, and barrens. In parts of southwestern Oregon, ponderosa pine types predominate. In the Coast Range of Oregon, the virgin Douglas-fir forests are broken by extensive even-aged second-growth forests varying in age from 40 to 80 years. These are the result of several large fires that burned during the middle of the 19th century . . . in the northwest is the great Tillamook burn, where roughly 380 square miles was deforested in 1933.

As business recovered during the World War II expansion period, western Oregon harvests surpassed those in western Washington based on increased production in the upper Willamette Valley and on the southern coast as the timber industry shifted south. Lane County produced 885 million board feet in 1941, followed by Coos County with 678 million board feet. Clatsop County ranked third, followed by Linn County. By 1952, the Oregon timber industry was in high gear in southwestern Oregon. That year, Douglas and Lane Counties led all the Nation's counties with log production levels of 1.93 and 1.84 billion board feet, respectively. Also, Coos, Curry, Linn, and Jackson Counties were each producing well over two-thirds of a billion board feet at the 1952 production peak in western Oregon. Western Oregon's production remained at high levels through the 1960's based on the high cutting rates in these counties. As of 1970, Douglas County continued to lead in log production with 1.63 billion board feet, followed by Lane County with a harvest of 1.53 billion board feet. Linn County and Coos County still were cutting large quantities of timber and ranked third and fourth in 1970.

The western Oregon scene as of 1970 was composed of young-growth forests maturing in northwestern Oregon with low timber harvests in Columbia County and slightly increasing harvests in Clatsop County. In southern Oregon, the old-growth harvest continued, especially on the public lands. Large areas of forest land had been cut over and were covered with young sawtimber, pole-timber, and seedling and sapling stands. In 1963, there were 730,000 acres of nonstocked land in western Oregon, and 72 percent of these were in the central and southern counties of western Oregon (USDA Forest Service 1965). The rapid timber inventory depletion, the large areas of poorly stocked land, and the low net annual timber growth are indicators that the extremely high rates of log production in parts of western Oregon have a limited future.

Log Production Peaked in 1952 on Private Lands, in 1968 on Public Lands in Douglas-fir Region

In 1952, log production on private lands reached 11.31 billion board feet in the Douglas-fir region (fig. 4). This was the highest private harvest recorded since the 1929 production peak. After 1952, the overall private production trend in the Douglas-fir region was down until 1961, when it stabilized and began to rise slightly in the 1960's. In 1969, the peak year for the decade, total private log harvest was considerably below the 1952 peak. In 1970, the total private log harvest amounted to 8.42 billion board feet.

Public agencies have long had major forest inventories, but in the early 1900's their timber production was comparatively small. After World War II, the public lands took on more importance as a major source of raw material to meet the timber industry's needs. As a result, the public agencies' harvests began to rise. In 1949, public harvests amounted to 2.47 billion board feet in the Douglas-fir region (22 percent of total production), and by 1968 public production reached an alltime peak of 7.39 billion board feet (46 percent of the total harvest).

After 1968, public log production as well as stumpage prices declined, reflecting the recession in late 1969 and 1970. Public log production of 5.63 billion board feet in 1970 was 24 percent below the 1968 peak. This decline coincided with a sharp rise in the volume of public timber sold but not yet cut (Wall 1971a , 1971b).

Harvests on Public and Private Lands

The harvests from public lands have been larger in western Oregon than those in western Washington for many years. Since 1959, the timber industry in western Oregon has depended more on public timber harvests than in western Washington. In 1970, the harvests on public lands amounted to 3.46 billion board feet in western Oregon (47 percent of the western Oregon total) and 2.18 billion board feet in western Washington (32 percent of the western Washington total). It is likely that this high degree of dependency on public

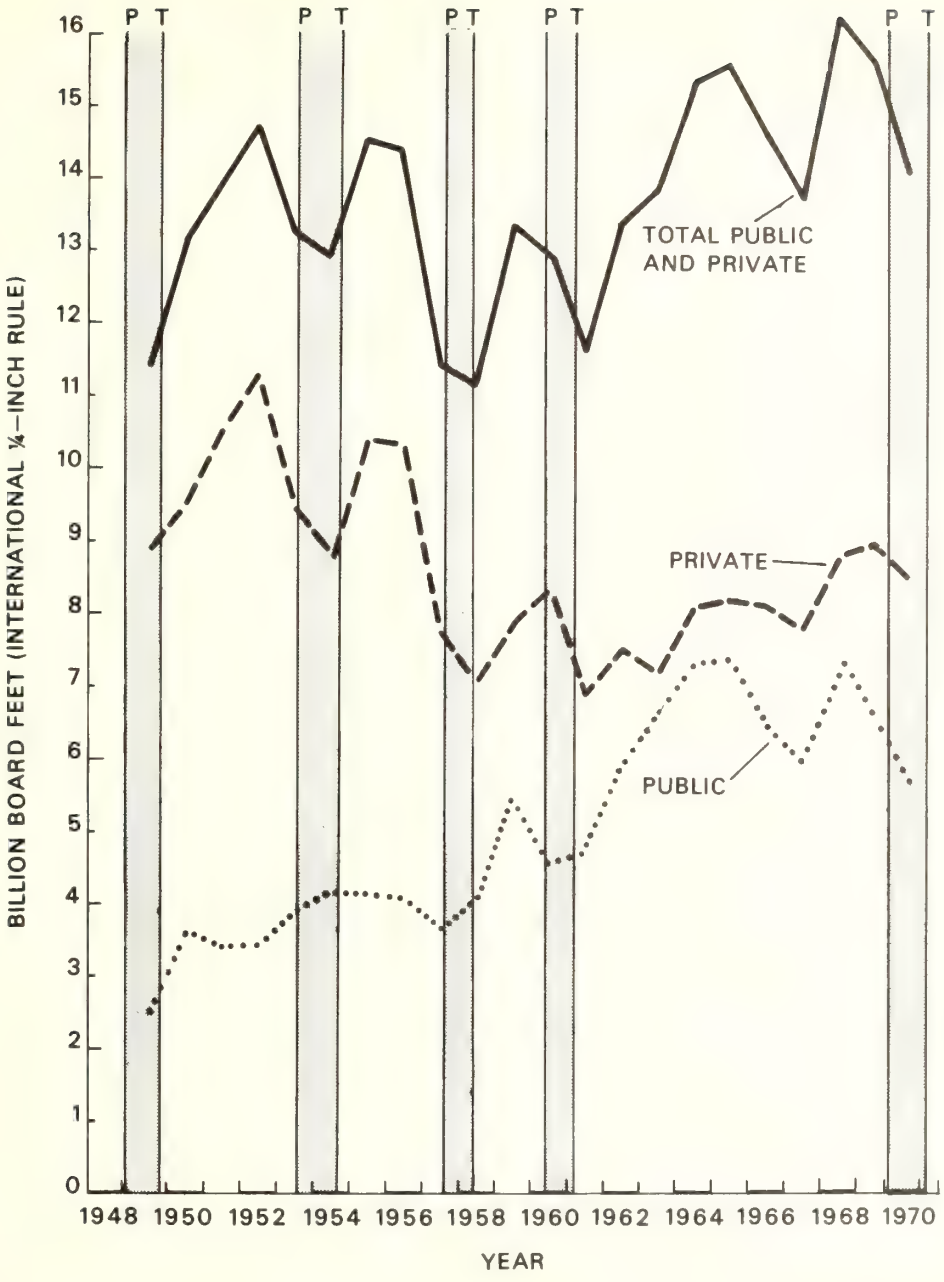

Figure 4.—Log production on private and public lands, Douglas-fir region, 1949-70.

timber in western Oregon and western Washington will continue for a long time, because 67 percent of the remaining softwood sawtimber inventory is in the public ownership class as of 1970.

Figures 5 through 8 show the relationships among public and private timber harvests in western Oregon and western Washington during the 1949-70 period. Figure 5 shows that western Oregon's public-private timber harvest

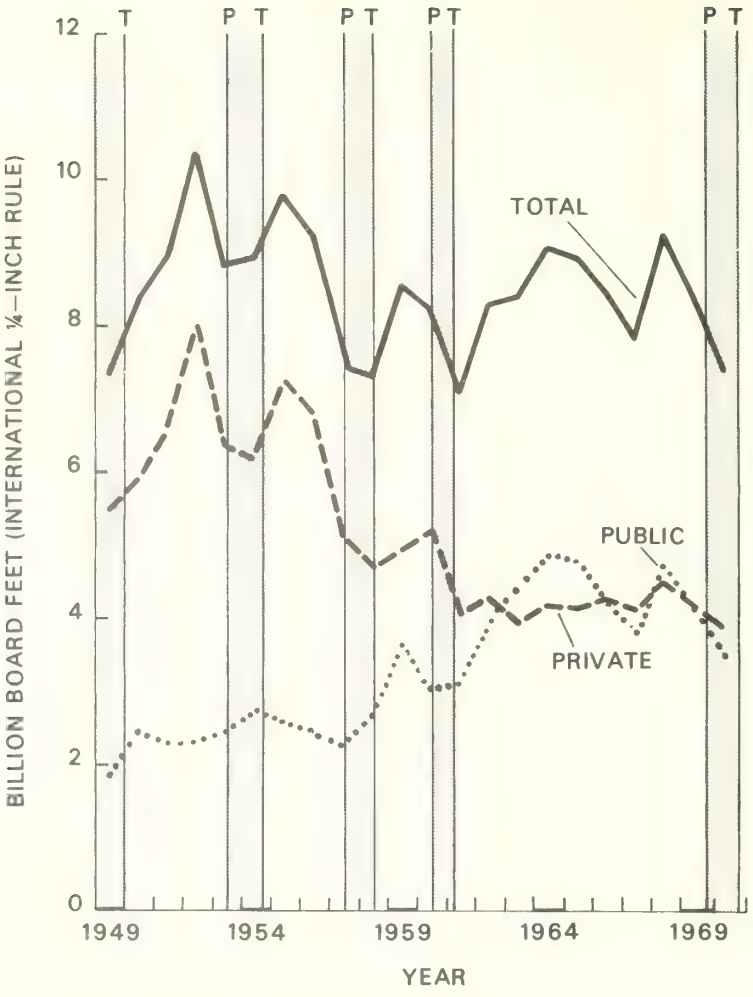

Figure 5.—Log production on private and public lands, western Oregon, 1949-70.

composition has been changing over time. The timber industry in this area, which was primarily dependent on private forest production in the early 1950's, became equally dependent on both public and private timber during the 1960's. In 1970, western Oregon's private timber harvest was 3.9 billion board feet, and this was 52 percent below the private timber harvest peak established in 1952. Industry's forest lands accounted for 91 percent of the private log production in 1970 (Wall 1971a). The industrial share of private production has fluctuated depending on business conditions. In the better business climate of 1969, the industrial share of the western Oregon harvest was lower than in 1970 (81 percent), reflecting the larger harvests on the nonindustrial private timberlands (Wall 1970).

Figure 6 shows that during the 1949-70 period the National Forests led public log producers except for the State of Oregon in 1949 and 1950. This

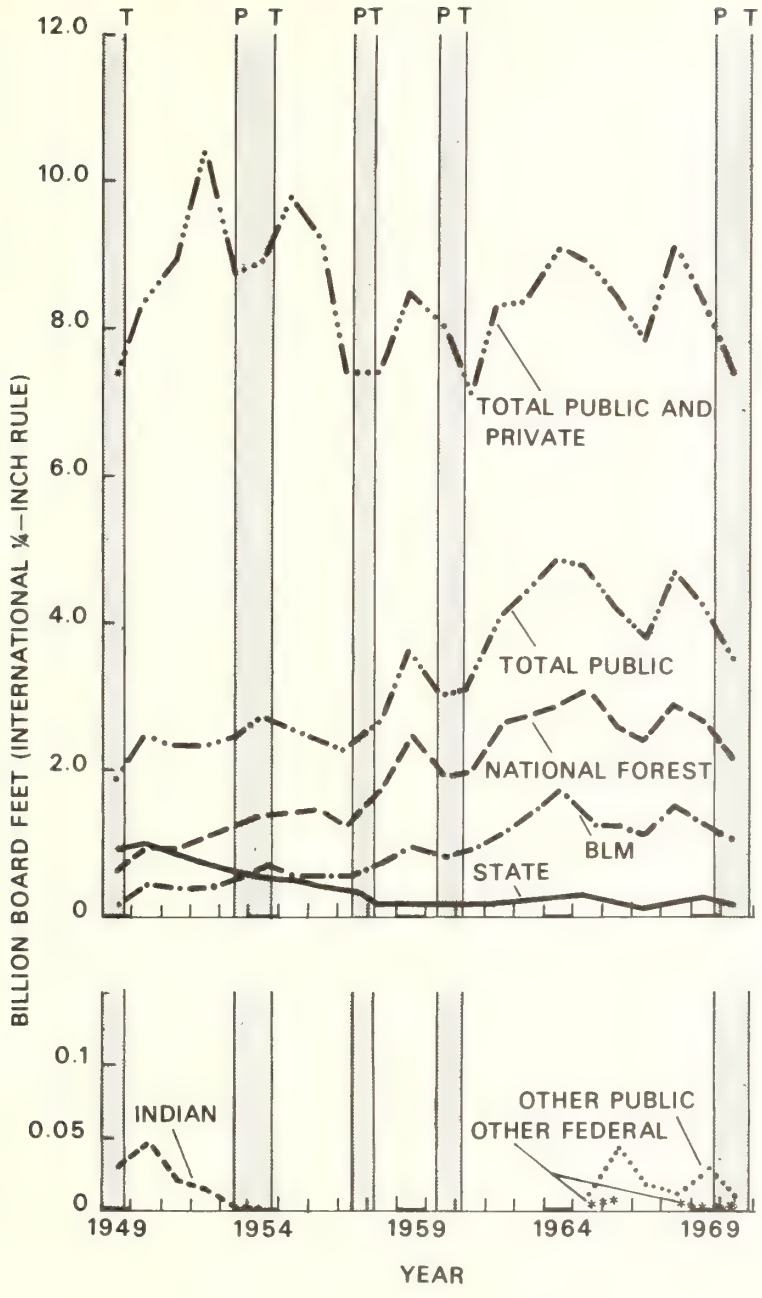

Figure 6.—Log production on public lands by land managing agency, western Oregon, 1949-70.

high State production was associated with salvage harvests from the successive Tillamook Burns. As of 1970, the National Forests were the largest single log-producing ownership in western Oregon, accounting for 30 percent (2.2 billion

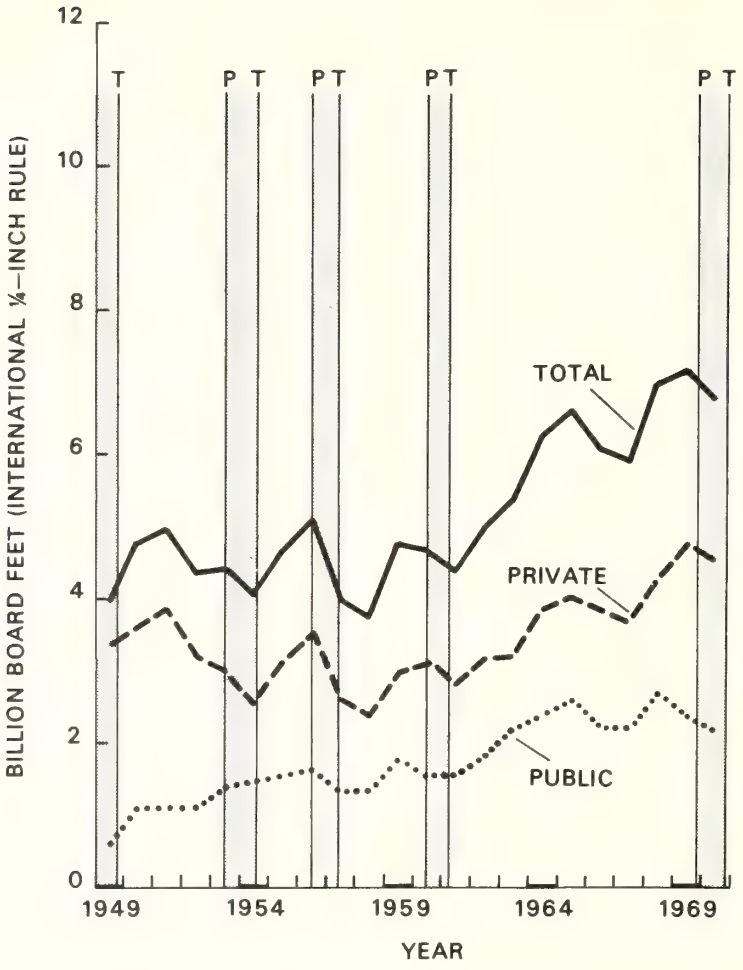

Figure 7.—Log production on private and public lands, western Washington, 1949-70.

board feet) of the total log harvest. Timber harvests from the Bureau of Land Management's (BLM) lands became increasingly important through the 1950's and the 1960's. The BLM's 1.1-billion-board-foot harvest in 1970 was 3.6 times larger than its 1949 harvest, and the 1970 cut accounted for 15 percent of the western Oregon total harvest.

In western Washington, private lands have always been the most important source of timber for the forest industries. Private production had a downward trend during the 1950's, with the lowest point being established in 1958 at 2.4 billion board feet (fig. 7). The recent rising trend in private timber harvests extended through 1970. About two-thirds of western Washington's total harvest came from private lands in 1970, and 85 percent of this private harvest was from industrial timberlands (Wall 1971b).

The rising trend results from both a favorable timber demand situation and a favorable timber supply situation. The consumption of wood products

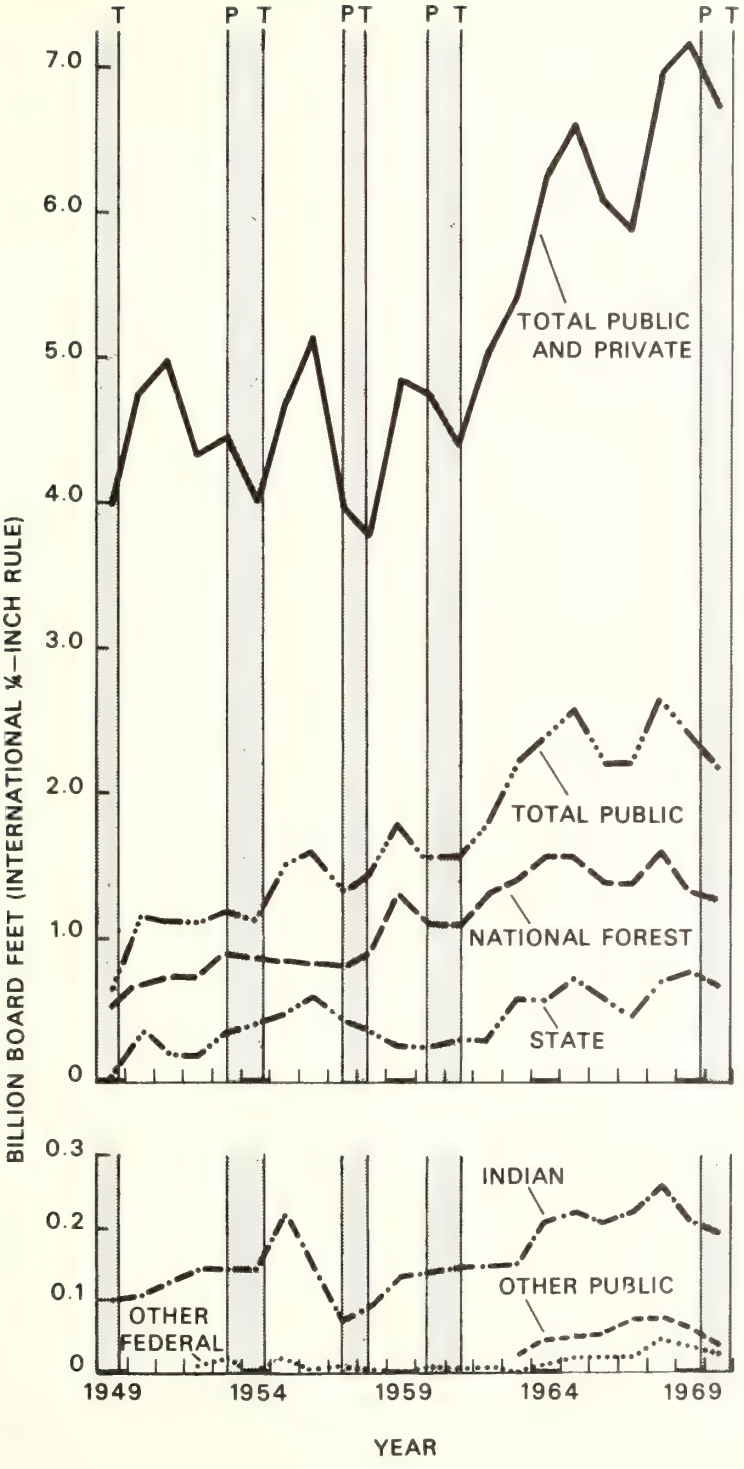

Figure 8.—Log production on public lands by land managing agency, western Washington, 1949-70.

has been increasing in the Nation, and the increased national demand has had a positive influence on harvest in the whole Pacific Northwest. In the 1960's, the foreign demand for Pacific Northwest "white wood" logs greatly increased. Western Washington was in a favorable position with good port and transportation facilities and large inventories of old-growth western hemlock, Sitka spruce, and true firs. As this timber demand increased, private forest-land owners began to increase their harvests of old growth and especially of these species, which previously had been neither as highly sought after nor as accessible.

Examination of the western Washington timber harvest by species mix and age class for private lands indicates the private owners' response to the change in demand for logs. In 1958, the private timber harvest was nearly 2 billion board feet (Scribner), and 73 percent of this came from trees over 100 years old (State of Washington 1959). About 66 percent of the Douglas-fir harvest was old growth, and the western hemlock and true fir harvests were 83-percent and 98-percent old growth, respectively.

By 1970, the total private harvest in western Washington had increased to 3.8 billion board feet (Scribner), and the old-growth share of the harvest had risen to 80 percent. Almost 89 percent of the 1.8-billion-board-foot increase in private timber harvest resulted from stepped-up production of old-growth timber. Western hemlock, Sitka spruce, and the true firs accounted for 927 million board feet of this old-growth harvest increase. About 90 percent of all the "white wood" timber harvest was from private timber 100 years of age or over. As a result of continued high demand for "white woods," the private harvest of western hemlock in 1970 amounted to 1.6 billion board feet in western Washington. By comparison the harvest of Douglas-fir from the private lands amounted to 1.5 billion board feet, and 74 percent of this was old growth.

In 1970, most of the "white wood" production from private lands came from industrial forest-land owners, and 92 percent of their hemlock and 96 percent of their true fir harvest was old growth (State of Washington 1971). A mill survey of Washington State shows that in 1970 foreign log exports consumed 1.7 billion board feet of timber, heavily weighted to "white woods," and 71 percent of this volume was from old growth. This same study indicated that 65 percent of the export volume came from private lands (Bergvall and Holtcamp 1971).

Public timber harvests in western Washington have been generally increasing during the past two decades. Increases in allowable cuts by the Department of Natural Resources and other public agencies in western Washington and elsewhere in the Pacific Northwest have been of major significance. With large quantities of timber being demanded, the public agencies have been able to sell additional amounts of timber in the past two decades, and the improved market situation has made it possible to raise the allowable cut based on previously unmerchantable timber. For example, allowable cut increases were based on calculations which include smaller diameter trees to reflect changing utilization, on expectations for increased growth rates due to the

inclusion of these smaller trees and more extensive forest management, on shorter rotation and regeneration periods, on inclusion of intermediate cuts, and on the addition of formerly inaccessible lands and a new intensive forest inventory.

A rapid increase in recent years has been on State lands managed by the Department of Natural Resources (fig. 8). In 1970, the timber harvest amounted to 663 million board feet--a 101-percent increase in production since 1950. The National Forests were the largest timber producers in western Washington in 1970, with a harvest of 1.3 billion board feet; this was 84 percent above the 1950 harvest. The National Forest harvest peaked in 1968 at 1.6 billion board feet, and the State timber harvest peaked in 1969 at 765 million board feet.

PONDEROSA PINE REGION LOG PRODUCTION

With the exception of the depression in the 1930's and a short period after World War II, the general log production trend in the ponderosa pine region has been a rising one. Figure 9 shows this trend in both eastern Oregon and eastern Washington. Eastern Oregon, the larger producer of the two, had in 1969 a harvest of 2.2 billion board feet, an alltime record. In 1970, eastern Oregon's harvest dropped 13 percent from this peak to 1.9 billion board feet. Eastern Washington reached an alltime peak in log production in 1968 at 1.26 billion board feet. With the slump in business in 1970, log harvest dropped to 953 million board feet in eastern Washington.

Opposite Trends for Public and Private Lands

Figure 10 shows that in the ponderosa pine region both public and private production increased until the mid-1950's. Since that time, public log production generally continued to increase, but private production turned down. Figures 11 and 12 show similar patterns for eastern Oregon and Washington.

In both States, the National Forests account for much of the increase in timber harvests. Figure 13 shows this is especially true in eastern Oregon, and figure 14 shows that in eastern Washington the Indian lands have also accounted for a good part of the increase. Since about 1961, a part of the increase in eastern Oregon National Forest production resulted from the transfer of the bulk of the Klamath Indian lands to form the Winema National Forest.

East-Side Harvest Influenced by Markets and Timber Considerations

Log production increased in eastern Oregon and eastern Washington as the lumber industry was attracted to specific timber species and easy logging situations. Ponderosa pine and western white pine were the principal species sought after in the early years. The industry moved to areas where these species were concentrated and timber access problems were minimal. Timber

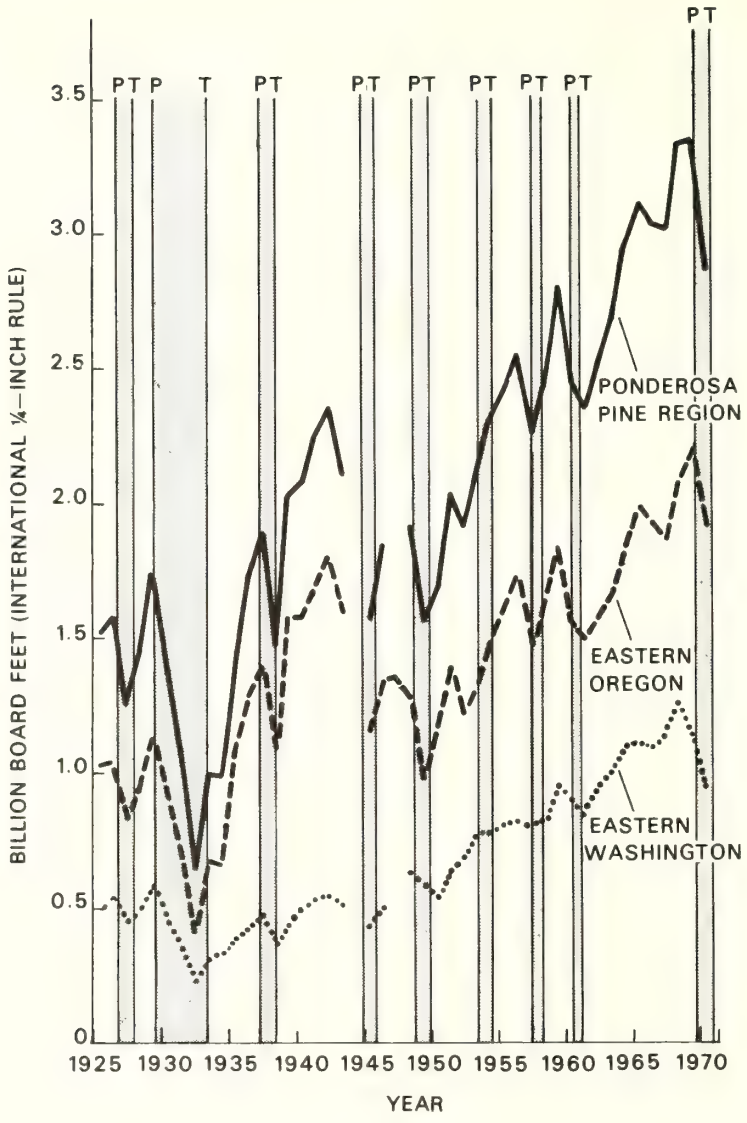

Figure 9.—Log production in the ponderosa pine region of Washington and Oregon, 1925-43, 1945-46, and 1948-70.

harvesting within the ponderosa pine region developed at somewhat different rates, depending on such factors as the timber species, the timber stand volume per acre, the topography, the ownership of the land, the distance to market, and the adequacy of the timber markets.

Favorable economic factors for timber industry development and the large inventory of old-growth ponderosa pine attracted early lumbermen to eastern Oregon's Cascade Range and the Klamath Plateau. As a result, Klamath County has long been the leading wood producer in the ponderosa pine region. In 1925, Klamath County produced 406 million board feet of logs, and in 1970 it led with a harvest of 460 million board feet. Deschutes County also attracted

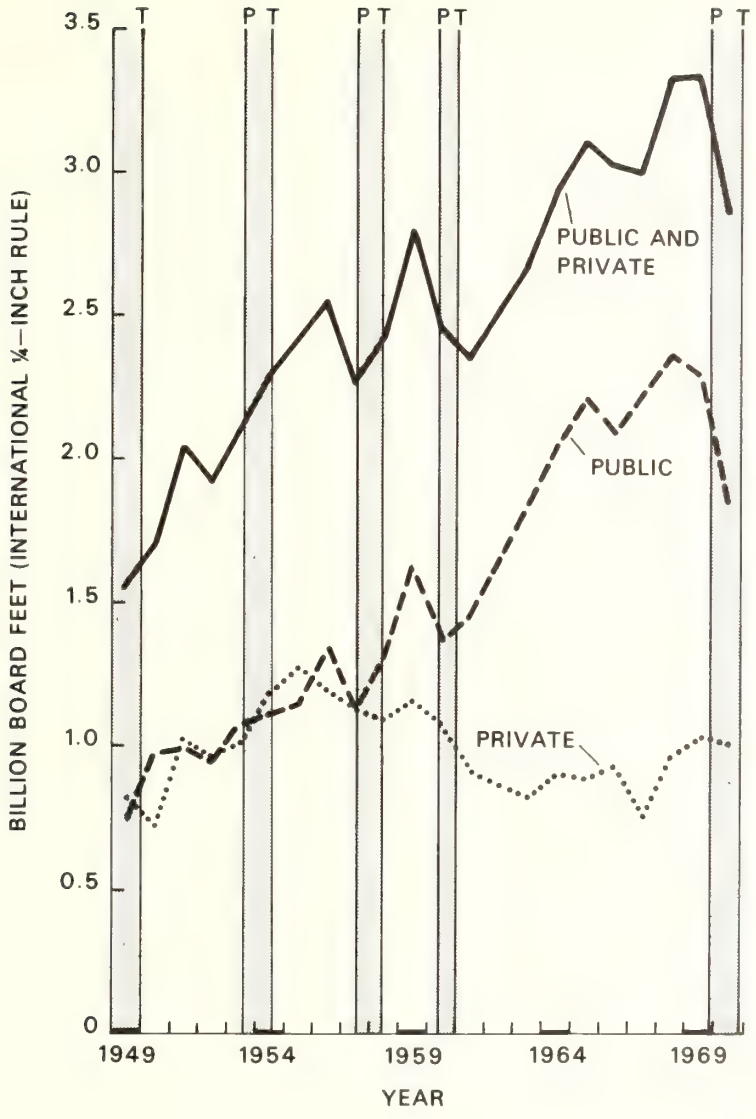

Figure 10.—Log production on private and public lands, ponderosa pine region, 1949-70.

the early loggers and lumbermen for similar reasons. Its peak production came in the 1920's, and in 1925 it ranked second in the region. Lake County is a county with a long cycle fluctuation in timber harvest which was large during the 1930's and then dropped. Production increased later on, especially in the 1960's, and in 1970 it ranked second in the ponderosa pine region with a 277-million-board-foot harvest.

The Blue Mountain area of eastern Oregon was slow to develop due to long hauls to market and a more mixed timber inventory. In this area, log production increased in Grant County in the 1950's, peaked in 1956 at 305

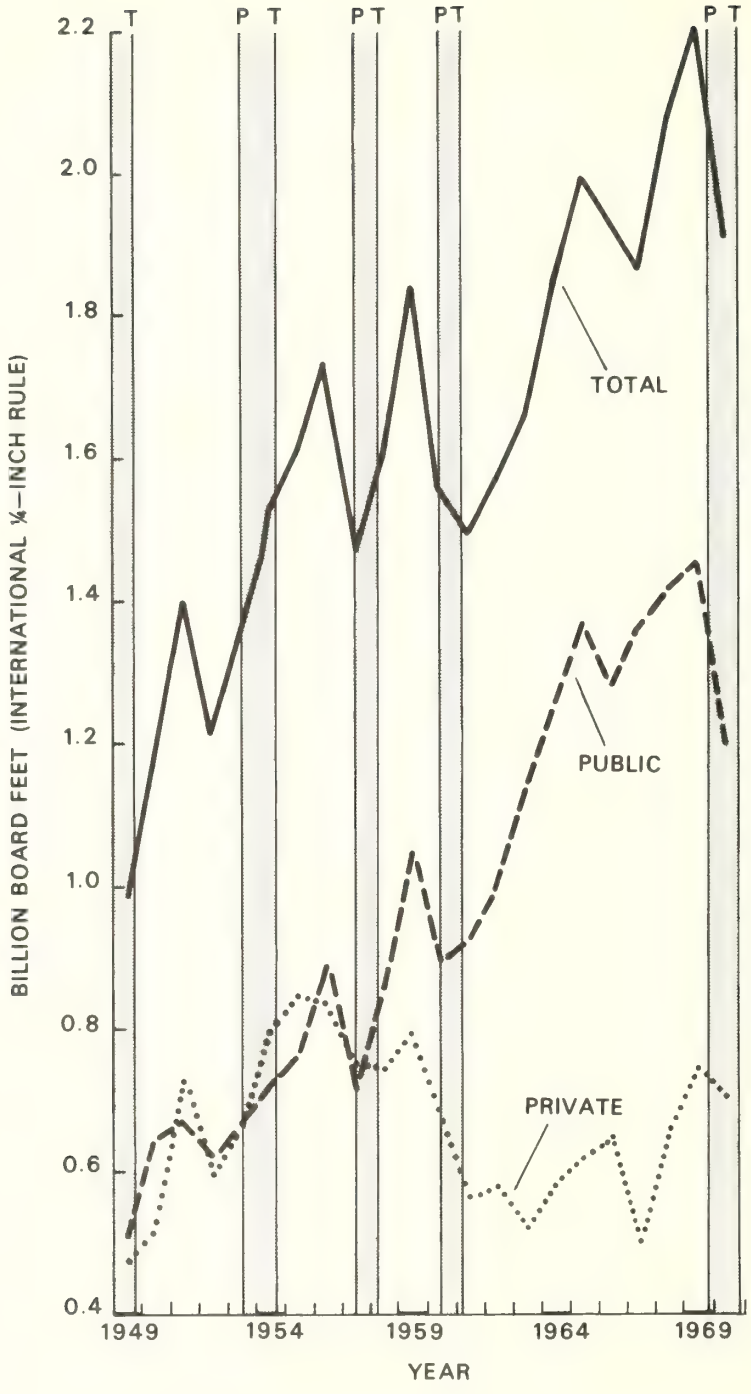

Figure 11.—Log production on public and private lands, eastern Oregon, 1949-70.

million board feet, and since then has maintained a high level. In 1970, Grant County was the ponderosa pine region's third largest timber producer with a 251-million-board-foot harvest.

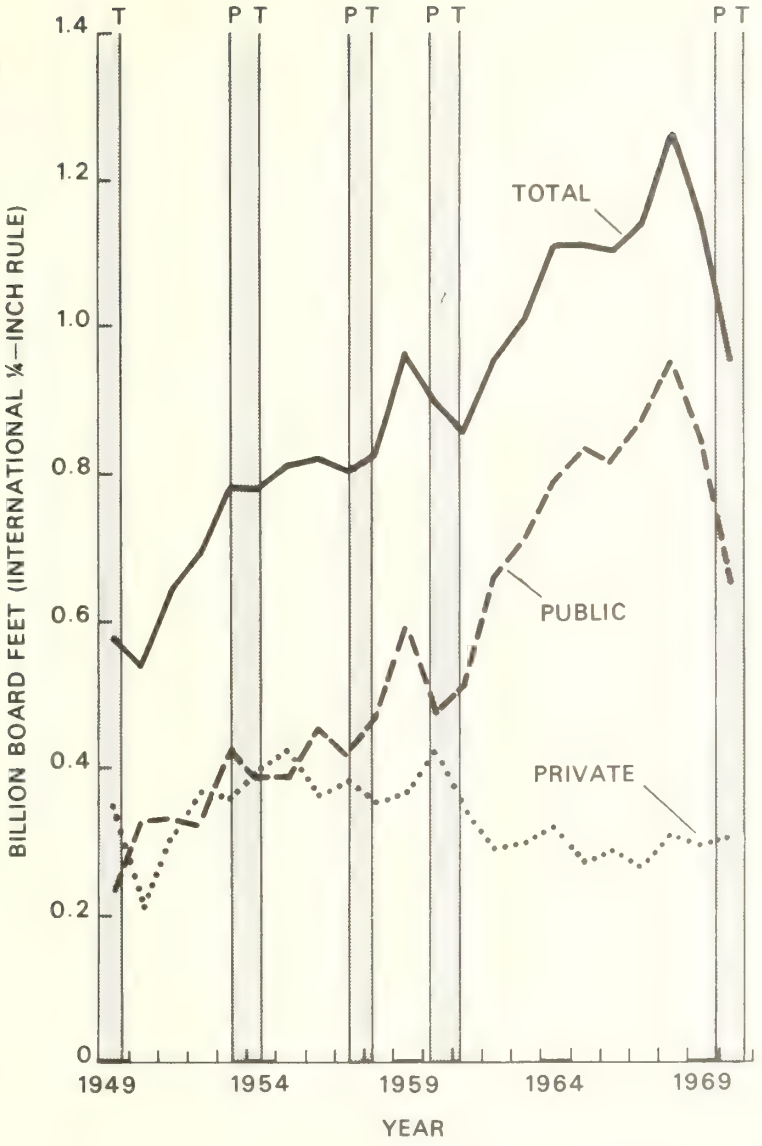

Figure 12.—Log production on public and private lands, eastern Washington, 1949-70.

Between 1925 and 1970, there was a trend toward a broader species mix in the eastern Oregon timber harvest. This has come about as market conditions have changed and as the higher elevation species on the National Forests have become available. In 1925, ponderosa pine accounted for 96 percent of eastern Oregon's harvest, and in 1968 the proportion was estimated to be 72 percent (Moravets 1950, Manock et al. 1970).

Eastern Washington has always had a wider range of species in its timber harvest, reflecting its diverse forest composition and geographic location. Stevens, Pend Oreille, and Spokane Counties had large areas of western white

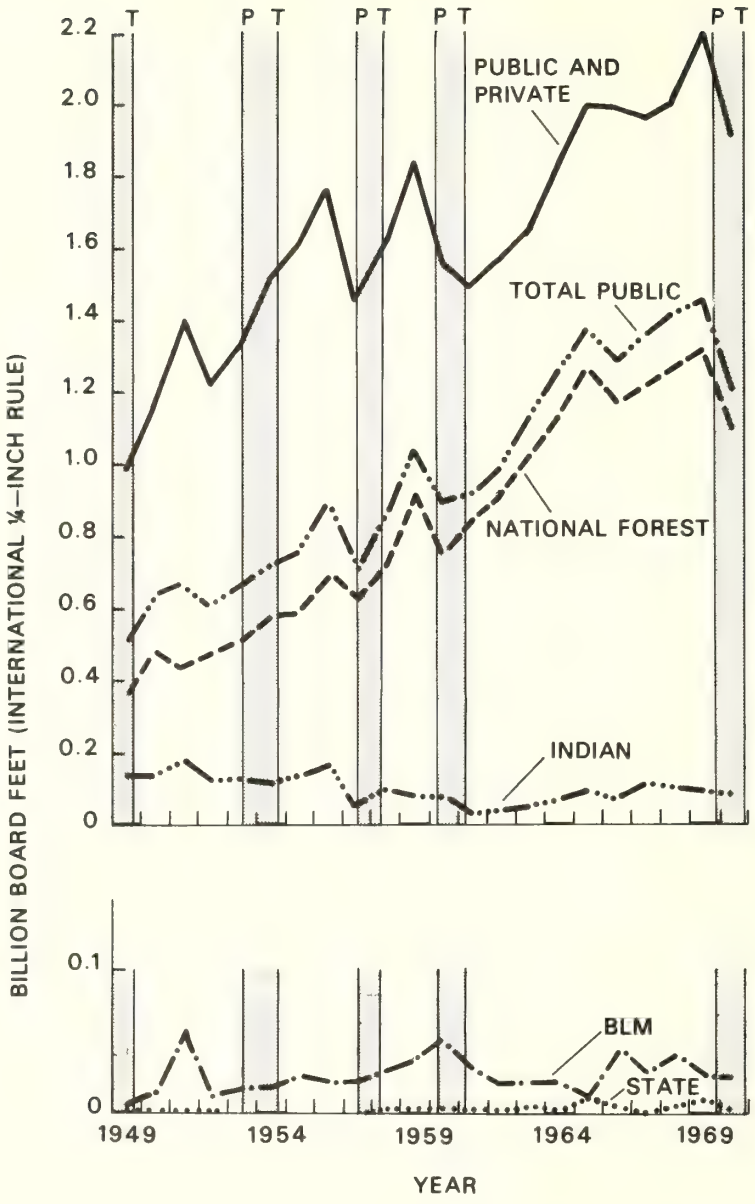

Figure 13.—Log production on public lands by land managing agency, eastern Oregon, 1949-70.

pine as well as ponderosa pine. These species attracted lumbermen and early loggers to northeast Washington. In 1925, Stevens County led eastern Washington's timber harvest with 82 million board feet of production. During the 1920's both ponderosa pine and Douglas-fir were being produced in the lower elevations of the Cascade Range. In 1925, Kittitas and Chelan Counties ranked second and third in eastern Washington. Klickitat County's forests were characterized by their extensive areas of high quality ponderosa pine forests. These were the basis for a large timber harvest throughout the 1925-70 period.

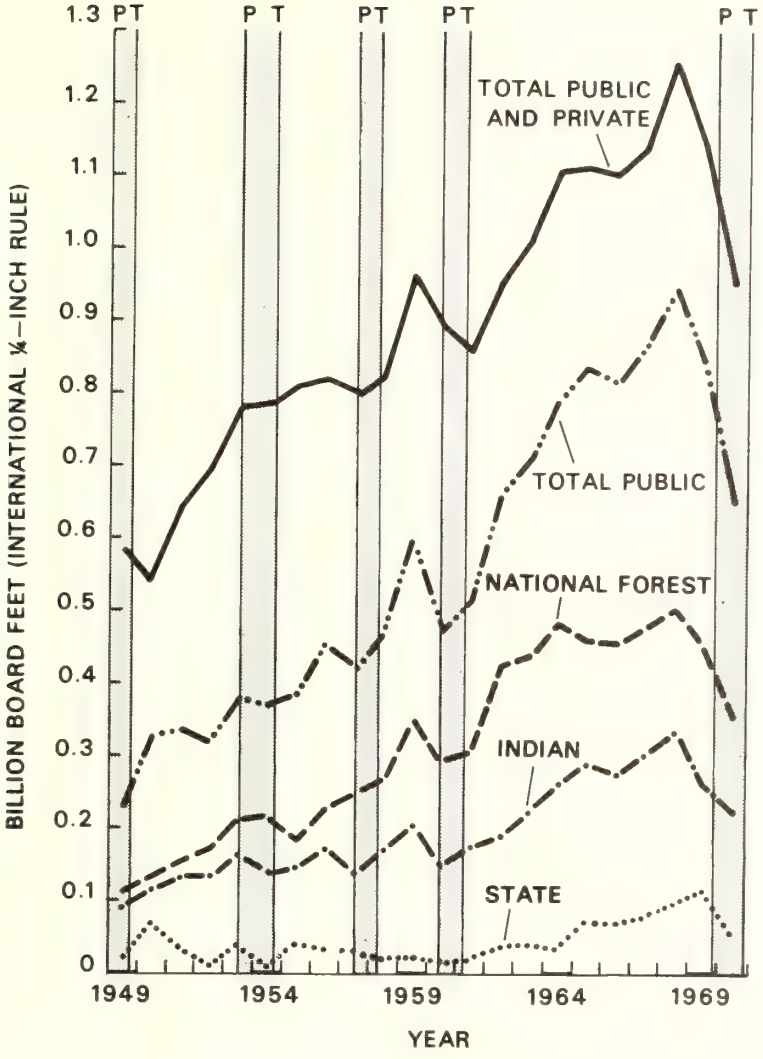

Figure 14.—Log production on public lands by land managing agency, eastern Washington, 1949-70.

For a number of years, some areas in the ponderosa pine region were inaccessible for logging. For example, one such area with virgin timber stands was located east and north of the Okanogan River in eastern Washington. This area encompassed the slopes and hills of the Colville Mountains (Cowlin et al. 1942). Since the 1940's, access has improved and log production has increased. Yakima County is another example of increasing access and log production since the early 1940's. The harvests from both the National Forests and Indian lands account for this production increase. In 1970, Yakima County was the leading log producer in eastern Washington with a harvest of 231 million board feet. Increased access and log production on the National Forests and Indian lands also account for the importance of Ferry County in eastern Washington's timber economy. In 1970, Ferry County ranked second in log production followed by Okanogan County.

Between 1925 and 1970 the species distribution of the harvests changed in eastern Washington as logging progressed into new counties and higher elevations. In 1925, ponderosa pine accounted for 72 percent of the harvest, Douglas-fir 14 percent, western white pine 7 percent, western larch 4 percent, and other species the remaining 3 percent. As of 1970, the harvests of ponderosa pine and Douglas-fir were nearly equal at 35 and 33 percent of the total, respectively. Western white pine had dropped to 1 percent of the total harvest, but western larch had risen to 10 percent (Moravets 1950, State of Washington 1971).

BACKGROUND ON DATA

The log production data in this publication are in terms of International 1/4-inch scale. The original data were mostly on a Scribner log scale basis. The bases for the estimates have varied over time. For the purposes of this report, International 1/4-inch data were derived by converting Scribner estimates. The original Scribner data for the Douglas-fir region were multiplied by a factor of 1.207 and by a factor of 1.07 in the ponderosa pine region. The International scale gives generally higher board-foot estimates than Scribner scale, and it more closely approximates actual lumber yield from a log when it is sawn. One other adjustment was made in the original Scribner data. The Bureau of Land Management's harvest data in western Oregon and western Washington were originally on a 16-foot log basis. These data were converted to the more common 32-foot basis by reducing reported production by 12 percent and then converting to International 1/4-inch volume.

By use of a constant factor for converting to International log scale over time, it is assumed that the diameter of the logs harvested has not changed on the average over time. This is not an entirely true assumption since young timber has been increasingly cut and removed on some ownerships. But most of the timber cut is still large old growth, and it was believed that use of a constant factor would not unduly distort the long-term trends.

The Forest Service first began compiling log production statistics in 1925. In 1950, F. L. Moravets published comprehensive log production data in "Production of Logs in Oregon and Washington, 1925-48." The data in this report for these years are based on Moravets' report. The basis for these early data was a questionnaire, Form S -- Stumpage and Log Transactions, which was mailed to all known log producers in Oregon and Washington during the period 1925-43 and in 1945. The mail canvass of log production was supplemented by a field followup of all nonrespondents. For each odd year during the 1925-39 period, information on total log production was obtained from a census of manufactures, "Logs, Lumber, and Other Timber Products," conducted by the Bureau of the Census and the Forest Service. This information provided a check on log production statistics.

The Forest Service conducted the mail canvass survey and a field followup to obtain log production estimates for 1946 and 1948 for Washington and for

1946 for Oregon. Statistics for Oregon in 1947 and 1948 were based on data collected by the State Forester's office on private, State, and Federal revested lands; by the Forest Service on National Forest lands; and by the Indian Service on Indian lands. Production data were not collected for 1944 for either State, and no data were collected for Washington State for 1947 (Moravets 1950).

The Pacific Northwest Forest and Range Experiment Station compiled log production statistics in cooperation with State and Federal agencies during the 1949-70 period. These data are the basis for log production statistics by owner and by county in this report. For the purpose of this report, the data on log production by ownership are reconstructed for the private, State, and Bureau of Land Management ownership during the early 1950's. This reconstruction was accomplished by examining and employing early timber sale and cutting records. As a result, early log production State totals have remained unchanged, but the internal private, State land, and Bureau of Land Management figures by county for the early 1950's are estimates based on other early records.

In the State of Washington, early timber harvest records were prepared by the Division of Forestry. Later on in the mid-1950's the Department of Natural Resources was formed and took over this function. The State of Washington prepares a detailed timber harvest report each year. In the State of Oregon, the office of the State Forester has collected private, State, county, and municipal log production data, and the Pacific Northwest Forest and Range Experiment Station has compiled and supplied the timber harvest data for the Federal agencies as the basis for one-page reports issued by both the Station and the Oregon State Department of Forestry. The State agencies collect the private, municipal, and county timber harvest data in connection with gathering information required for the administration of the Forest Practice Act in the State of Washington and the Conservation Act in the State of Oregon. These data have been used in this report.

In 1968, interviews were conducted with a wide range of State and Federal employees who had actively participated in preparing log production data during the 1949-68 period. Many of the older men felt that there had been definite improvement in the collection of log production statistics over the years. Over time, more forest area has been covered by fire protection districts in Oregon. Only the agricultural area of the Willamette Valley and a few scattered areas in eastern Oregon lacked systematic log production reporting, and the amount of wood actually harvested there is believed to be very small. The use of aerial photos by foresters, better recordkeeping by loggers, and better reporting by timberland owners have led to more accurate reports over time. Since 1968, greater accuracy for industrial private lands has been achieved when the Washington Forest Protection Association began assisting the Department of Natural Resources by compiling industrial production by county. Until that time, some industrial timber owners in Washington did not supply timber volume cut but, instead, reported their area cutover in compliance with the law. This put the burden of volume estimation for some large ownerships on the local Forest Practice Forester and the accuracy depended on his skill. As of 1970, local

State Foresters in Washington State estimated the volume cut on small ownerships when the owners did not volunteer the information, and this was true in Oregon for a very few nonreporting ownerships as of 1970. It is generally agreed that most of the timber in both States is measured at some point in the production process and that most of this is reported.

Data on the Bureau of Land Management's timber harvest are based on estimates of production from active timber sales. The volume estimates are based on the lump sum timber sale cruises, and the original estimates are in the Scribner log scale based on 16-foot volume tables. The Bureau of Land Management data have been revised in this report to make them comparable to other reported data. Because of the method of reporting production for the Bureau of Land Management, cull logs, small sound logs, and chunks actually harvested do not appear in the production estimates. Thus, the report has a low bias which can possibly be as much as 10 percent for some areas of old-growth timber production.

The Bureau of Indian Affairs compiled the production of logs, poles and pilings, and shingles harvested from Indian lands in Oregon and Washington. Cull log volumes are also included for these lands. On the west side, Scaling Bureau truck scale standard was used; and on the east side of the Cascade Range, Forest Service 16-foot log scale was used as a basis of measurement and reporting. Except for the small amount of timber used by the Indians themselves, all timber removed from Indian lands has been measured and reported.

The U.S. Forest Service keeps complete records of the timber volumes sold and cut, and most of this volume has been truck-scaled by the Forest Service or a scaling bureau during the 1949-70 period. Harvests from lump sum sales were estimated based on the timber cruise volumes. The Forest Service figures include data on dead, cull, and sound log production. Almost all Forest Service production volumes result from actual measurements; the very small amount from lump sum sales was estimated from the timber cruise volumes.

Production estimates for State-owned or -managed lands in both Oregon and Washington are based on both truck scale and cash sale (lump sum) timber cruises. In the early 1950's, cash sales were common, and volume estimates of timber production were based on timber cruise data. Later in the 1950's, the basis of payment for State sales mostly became the actual State or Scaling Bureau scale of the timber harvested, and these data became the basis for the log production figures. In the late 1960's with the advent of thinning in young-growth timber, the cruise volume estimates of production from cash thinning sales have became a basis for some of the log production figures from State lands.

During the past 20 years, there have been six independent industry studies covering the forest industries in counties, in half States, or in all of Washington and Oregon. Complete mill samples were taken, and the managers

were asked where the logs consumed by the mill were produced. These independent mill survey results show that there is a very high degree of correlation between survey log production estimates and log production data compiled by the Pacific Northwest Forest and Range Experiment Station and based on timberland owners' production reports.

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APPENDIX OF TABLES

Table 1.–Log production in the States of Washington and Oregon by public and private lands, 1949-70

(Thousand board feet, International 1/4-inch scale)

Year	Washington				Oregon				Washington and Oregon			
	Public	Private	Public percent	Total	Public	Private	Public percent	Total	Public	Private	Public percent	Total
1949	860,631	3,712,561	19	4,573,192	2,354,600	6,022,343	28	8,376,943	3,215,231	9,734,904	25	12,950,135
1950	1,458,765	3,851,613	27	5,310,378	3,108,978	6,448,372	33	9,557,350	4,567,743	10,299,985	31	14,867,728
1951	1,446,054	4,181,197	26	5,627,251	2,980,338	7,358,091	29	10,338,429	4,426,392	11,539,288	28	15,965,680
1952	1,428,167	3,591,888	28	5,020,055	2,929,781	8,682,844	25	11,612,625	4,357,948	12,274,732	26	16,632,680
1953	1,838,132	3,396,082	35	5,234,214	3,105,198	7,023,848	31	10,129,046	4,943,330	10,419,930	32	15,363,260
1954	1,831,392	2,953,515	38	4,784,907	3,449,806	7,003,222	33	10,453,028	5,281,198	9,956,737	35	15,237,935
1955	1,950,077	3,559,277	35	5,509,354	3,337,983	8,096,934	29	11,434,917	5,288,060	11,656,211	31	16,944,271
1956	2,082,514	3,889,342	35	5,971,856	3,340,824	7,630,446	30	10,971,270	5,423,338	11,519,788	32	16,943,126
1957	1,778,680	3,005,561	37	4,784,241	2,972,758	5,886,124	34	8,858,882	4,751,438	8,891,685	35	13,643,123
1958	1,855,613	2,720,693	41	4,576,306	3,544,183	5,450,933	39	8,995,116	5,399,796	8,171,626	40	13,571,422
1959	2,398,711	3,353,582	42	5,752,293	4,699,942	5,720,512	45	10,420,454	7,098,653	9,074,094	44	16,172,747
1960	2,023,578	3,566,809	36	5,590,387	3,905,948	5,897,851	40	9,803,799	5,929,526	9,464,660	39	15,394,186
1961	2,086,864	3,157,784	40	5,244,648	4,053,044	4,580,210	47	8,633,254	6,139,908	7,737,994	44	13,877,902
1962	2,490,061	3,484,756	42	5,974,817	5,027,925	4,873,486	51	9,901,411	7,517,986	8,358,242	47	15,876,228
1963	2,917,939	3,503,820	45	6,421,759	5,571,987	4,491,557	55	10,063,544	8,489,926	7,995,377	52	16,485,303
1964	3,203,171	4,187,958	43	7,391,129	6,126,941	4,770,279	56	10,897,220	9,330,112	8,958,237	51	18,288,349
1965	3,430,289	4,299,057	44	7,729,346	6,116,219	4,788,725	56	10,904,944	9,546,508	9,087,782	48	18,634,290
1966	3,052,805	4,139,112	42	7,191,917	5,453,358	4,893,878	53	10,347,236	8,506,163	9,032,990	48	17,539,153
1967	3,057,702	3,961,506	44	7,019,208	5,132,438	4,562,110	53	9,694,548	8,190,140	8,523,616	49	16,713,756
1968	3,638,019	4,614,475	44	8,252,494	6,116,151	5,170,003	54	11,286,154	9,754,170	9,784,478	50	19,538,648
1969	3,239,629	5,068,023	39	8,307,652	5,660,159	4,931,607	53	10,591,766	8,899,788	9,999,630	47	18,899,418
1970	2,830,641	4,844,399	40	7,675,040	4,655,991	4,585,788	50	9,241,779	7,486,632	9,430,187	44	16,916,819

Table 2.–Log production in Washington and Oregon by region and half State, 1925-43 and 1945-70

(Thousand board feet, International 1/4-inch scale)

Year	Douglas-fir region			Ponderosa pine region			Washington	Oregon	Total
	Western Washington	Western Oregon	Total	Eastern Washington	Eastern Oregon	Total			
1925	7,200,629	3,469,865	10,670,494	500,592	1,024,492	1,525,084	7,701,221	4,494,357	12,195,578
1926	7,146,917	3,509,226	10,656,143	544,946	1,038,374	1,583,320	7,691,863	4,547,600	12,239,463
1927	7,693,903	3,619,063	11,312,966	454,810	809,724	1,264,534	8,148,713	4,428,787	12,577,500
1928	8,059,434	3,741,380	11,800,814	500,044	966,804	1,466,848	8,559,478	4,708,184	13,267,662
1929	8,242,237	4,182,563	12,424,800	594,395	1,139,079	1,733,474	8,836,632	5,321,642	14,158,274
1930	5,237,971	2,665,515	7,903,486	446,088	929,001	1,375,089	5,684,059	3,594,516	9,278,575
1931	3,900,006	1,908,525	5,808,531	369,487	723,342	1,092,829	4,269,493	2,631,867	6,901,360
1932	2,465,136	1,291,173	3,756,309	235,341	420,804	656,145	2,700,477	1,711,977	4,412,454
1933	3,855,553	1,900,464	5,756,017	319,609	676,047	995,656	4,175,162	2,576,511	6,751,673
1934	4,074,210	2,420,259	6,494,469	330,400	659,778	990,178	4,404,610	3,080,037	7,484,647
1935	4,046,103	2,721,889	6,767,992	383,467	1,085,986	1,469,453	4,429,570	3,807,875	8,237,445
1936	5,576,740	3,455,321	9,032,061	433,714	1,298,002	1,731,716	6,010,454	4,753,323	10,763,777
1937	5,625,499	4,074,144	9,699,643	476,751	1,419,927	1,896,678	6,102,250	5,494,071	11,596,321
1938	3,665,501	3,322,391	6,987,892	370,847	1,098,930	1,469,777	4,036,348	4,421,321	8,457,669
1939	4,857,976	4,042,744	8,900,720	445,065	1,578,591	2,023,656	5,303,041	5,621,335	10,924,376
1940	5,456,132	4,682,701	10,138,833	495,882	1,582,616	2,078,498	5,952,014	6,265,317	12,217,331
1941	5,611,924	6,355,108	11,967,032	529,152	1,710,851	2,240,003	6,141,076	8,065,959	14,207,035
1942	5,334,166	6,320,298	11,654,464	545,818	1,812,359	2,358,177	5,879,984	8,132,657	14,012,641
1943	5,015,083	6,705,491	11,720,574	511,724	1,595,415	2,107,139	5,526,807	8,300,906	13,827,713
1945	3,596,002	5,833,305	9,429,307	432,841	1,145,094	1,577,935	4,028,843	6,978,399	11,007,242
1946	4,058,780	6,559,709	10,618,489	498,865	1,342,652	1,841,517	4,557,645	7,902,361	12,460,006
1947	(1/)	8,007,750	(1/)	(1/)	1,354,696	(1/)	(1/)	9,362,446	(1/)
1948	4,241,400	8,694,808	12,936,208	640,360	1,274,344	1,914,704	4,881,760	9,969,152	14,850,912
1949	3,992,336	7,389,496	11,381,832	580,856	987,447	1,568,303	4,573,192	8,376,943	12,950,135
1950	4,770,202	8,394,543	13,164,745	540,176	1,162,807	1,702,983	5,310,378	9,557,350	14,867,728
1951	4,980,868	8,938,130	13,918,998	646,383	1,400,299	2,046,682	5,627,251	10,338,429	15,965,680
1952	4,324,531	10,395,523	14,720,054	695,524	1,217,102	1,912,626	5,020,055	11,612,625	16,632,680
1953	4,454,180	8,799,376	13,253,556	780,034	1,329,670	2,109,704	5,234,214	10,129,046	15,363,260
1954	4,000,717	8,931,092	12,931,809	784,190	1,521,936	2,306,126	4,784,907	10,453,028	15,237,935
1955	4,697,883	9,822,650	14,520,533	811,471	1,612,267	2,423,738	5,509,354	11,434,917	16,944,271
1956	5,150,674	9,234,758	14,385,432	821,182	1,736,512	2,557,694	5,971,856	10,971,270	16,943,126
1957	3,978,225	7,397,732	11,375,957	806,016	1,461,150	2,267,166	4,784,241	8,858,882	13,643,123
1958	3,750,289	7,391,604	11,141,893	826,017	1,603,512	2,429,529	4,576,306	8,995,116	13,571,422
1959	4,786,576	8,579,136	13,365,712	965,717	1,841,318	2,807,035	5,752,293	10,420,454	16,172,747
1960	4,693,611	8,245,754	12,939,365	896,776	1,558,045	2,454,821	5,590,387	9,803,799	15,394,186
1961	4,391,280	7,141,832	11,533,112	853,368	1,491,422	2,344,790	5,244,648	8,633,254	13,877,902
1962	5,020,754	8,330,172	13,350,926	954,063	1,571,239	2,525,302	5,974,817	9,901,411	15,876,228
1963	5,411,281	8,399,909	13,811,190	1,010,478	1,663,635	2,674,113	6,421,759	10,063,544	16,485,303
1964	6,281,882	9,051,042	15,332,924	1,109,247	1,846,178	2,955,425	7,391,129	10,897,220	18,288,349
1965	6,616,986	8,911,176	15,528,162	1,112,360	1,993,768	3,106,128	7,729,346	10,904,944	18,634,290
1966	6,088,866	8,418,473	14,507,339	1,103,051	1,928,763	3,031,814	7,191,917	10,347,236	17,539,153
1967	5,880,426	7,832,007	13,712,433	1,138,782	1,862,541	3,001,323	7,019,208	9,694,548	16,713,756
1968	6,993,222	9,207,883	16,201,105	1,259,272	2,078,271	3,337,543	8,252,494	11,286,154	19,538,648
1969	7,164,526	8,390,228	15,554,754	1,143,126	2,201,538	3,344,664	8,307,652	10,591,766	18,899,418
1970	6,722,009	7,332,832	14,054,841	953,031	1,908,947	2,861,978	7,675,040	9,241,779	16,916,819

1/ Not available.

Table 3.–Log production in the Douglas-fir region by half State and by public and private lands, 1949-70

(Thousand board feet, International 1/4-inch scale)

Year	Western Washington				Western Oregon				Douglas-fir region			
	Public	Private	Public percent	Total	Public	Private	Public percent	Total	Public	Private	Public percent	Total
1949	632,178	3,360,158	16	3,992,336	1,841,230	5,548,266	25	7,389,496	2,473,408	8,908,424	22	11,381,832
1950	1,131,520	3,638,682	24	4,770,202	2,462,720	5,931,823	29	8,394,543	3,594,240	9,570,505	27	13,164,745
1951	1,108,861	3,872,007	22	4,980,868	2,309,945	6,628,185	26	8,938,130	3,418,806	10,500,192	25	13,918,998
1952	1,105,596	3,218,935	26	4,324,531	2,307,901	8,087,622	22	10,395,523	3,413,497	11,306,557	23	14,720,054
1953	1,417,113	3,037,067	32	4,454,180	2,437,711	6,361,665	28	8,799,376	3,854,824	9,398,732	29	13,253,556
1954	1,449,092	2,551,625	36	4,000,717	2,725,120	6,205,972	31	8,931,092	4,174,212	8,757,597	32	12,931,809
1955	1,564,240	3,133,643	33	4,697,883	2,574,869	7,247,781	26	9,822,650	4,139,109	10,381,424	29	14,520,533
1956	1,627,469	3,523,205	32	5,150,674	2,443,048	6,791,710	26	9,234,758	4,070,517	10,314,915	28	14,385,432
1957	1,355,374	2,622,851	34	3,978,225	2,264,144	5,133,588	31	7,397,732	3,619,518	7,756,439	32	11,375,957
1958	1,383,914	2,366,375	37	3,750,289	2,684,080	4,707,524	36	7,391,604	4,067,994	7,073,899	37	11,141,893
1959	1,801,936	2,984,640	38	4,786,576	3,652,220	4,926,916	43	8,579,136	5,454,156	7,911,556	41	13,365,712
1960	1,551,213	3,142,398	33	4,693,611	3,014,306	5,231,448	37	8,245,754	4,565,519	8,373,846	35	12,939,365
1961	1,572,952	2,818,328	36	4,391,280	3,127,670	4,014,162	44	7,141,832	4,700,622	6,832,490	41	11,533,112
1962	1,828,387	3,192,367	36	5,020,754	4,036,405	4,293,767	48	8,330,172	5,864,792	7,486,134	44	13,350,926
1963	2,206,222	3,205,059	41	5,411,281	4,432,649	3,967,260	53	8,399,909	6,638,871	7,172,319	48	13,811,190
1964	2,412,887	3,868,995	38	6,281,882	4,863,860	4,187,182	54	9,051,042	7,276,747	8,056,177	47	15,332,924
1965	2,592,735	4,024,251	39	6,616,986	4,745,446	4,165,730	53	8,911,176	7,338,181	8,189,981	47	15,528,162
1966	2,237,189	3,851,677	37	6,088,866	4,173,121	4,245,352	50	8,418,473	6,410,310	8,097,029	44	14,507,339
1967	2,187,447	3,692,979	37	5,880,426	3,771,098	4,060,909	48	7,832,007	5,958,545	7,753,888	43	13,712,433
1968	2,689,531	4,303,691	38	6,993,222	4,698,944	4,508,939	51	9,207,883	7,388,475	8,812,630	46	16,201,105
1969	2,392,982	4,771,544	33	7,164,526	4,207,215	4,183,013	50	8,390,228	6,600,197	8,954,557	42	15,554,754
1970	2,178,139	4,543,870	32	6,722,009	3,455,484	3,877,348	47	7,332,832	5,633,623	8,421,218	40	14,054,841

Table 4.–Log production in the Douglas-fir

(Thousand board feet,

Year	Western Washington							
	Private	State	Bureau of Land Management	National Forest	Indian	Other Federal	Other public	Total
1949	3,360,158	21,160	684	509,837	100,497	--	--	3,992,336
1950	3,638,682	330,520	7,505	685,456	108,039	--	--	4,770,202
1951	3,872,007	222,888	2,087	757,151	126,735	--	--	4,980,868
1952	3,218,935	182,070	587	770,791	143,236	8,912	--	4,324,531
1953	3,037,067	357,277	1,650	894,266	146,256	17,664	--	4,454,180
1954	2,551,625	416,821	3,563	879,539	141,206	7,963	--	4,000,717
1955	3,133,643	494,077	1,159	832,434	219,298	17,272	--	4,697,883
1956	3,523,205	597,415	1,810	877,730	143,910	6,604	--	5,150,674
1957	2,622,851	450,670	7,693	811,335	77,973	7,703	--	3,978,225
1958	2,366,375	345,380	5,165	936,730	93,536	3,103	--	3,750,289
1959	2,984,640	322,725	6,746	1,336,463	135,758	244	--	4,786,576
1960	3,142,398	307,356	124	1,096,250	140,403	7,080	--	4,693,611
1961	2,818,328	344,456	110	1,076,218	147,541	4,627	--	4,391,280
1962	3,192,367	353,090	--	1,322,992	147,180	5,125	--	5,020,754
1963	3,205,059	611,691	--	1,413,881	152,868	1,994	25,788	5,411,281
1964	3,868,995	606,576	--	1,537,962	210,493	11,688	46,168	6,281,882
1965	4,024,251	743,409	76	1,553,411	224,510	23,174	48,155	6,616,986
1966	3,851,677	570,633	1	1,381,590	208,529	23,613	52,823	6,088,866
1967	3,692,979	476,650	--	1,389,740	223,611	24,325	73,121	5,880,426
1968	4,303,691	710,512	--	1,595,983	261,204	46,486	75,346	6,993,222
1969	4,771,544	765,456	--	1,318,544	209,872	35,825	63,285	7,164,526
1970	4,543,870	662,941	--	1,261,805	190,667	23,579	39,147	6,722,009

region by half State and ownership, 1949-70

International 1/4-inch scale)

Western Oregon								Total Douglas-fir region
Private	State	Bureau of Land Management	National Forest	Indian	Other Federal	Other public	Total	
5,548,266	944,339	233,238	632,271	31,382	--	--	7,389,496	11,381,832
5,931,823	1,002,440	487,436	926,976	45,868	--	--	8,394,543	13,164,745
6,628,185	874,121	444,515	968,376	22,933	--	--	8,938,130	13,918,998
8,087,622	734,400	461,627	1,094,387	17,487	--	--	10,395,523	14,720,054
6,361,665	644,709	540,783	1,251,297	922	--	--	8,799,376	13,253,556
6,205,972	570,358	742,968	1,411,104	690	--	--	8,931,092	12,931,809
7,247,781	535,220	575,463	1,464,186	--	--	--	9,822,650	14,520,533
6,791,710	427,805	551,877	1,463,366	--	--	--	9,234,758	14,385,432
5,133,588	363,833	606,648	1,293,663	--	--	--	7,397,732	11,375,957
4,707,524	140,061	767,228	1,776,791	--	--	--	7,391,604	11,141,893
4,926,916	164,014	990,547	2,497,659	--	--	--	8,579,136	13,365,712
5,231,448	206,390	864,922	1,942,994	--	--	--	8,245,754	12,939,365
4,014,162	216,533	917,608	1,993,529	--	--	--	7,141,832	11,533,112
4,293,767	202,302	1,151,908	2,682,195	--	--	--	8,330,172	13,350,926
3,967,260	252,240	1,427,725	2,752,684	--	--	--	8,399,909	13,811,190
4,187,182	292,092	1,715,282	2,856,486	--	--	--	9,051,042	15,332,924
4,165,730	289,636	1,304,326	3,137,596	--	3,653	10,235	8,911,176	15,528,162
4,245,352	217,620	1,275,606	2,630,536	--	6,916	42,443	8,418,473	14,507,339
4,060,909	151,953	1,131,196	2,470,610	--	--	17,339	7,832,007	13,712,433
4,508,939	191,253	1,519,933	2,968,102	--	5,657	13,999	9,207,883	16,201,105
4,183,013	230,299	1,253,023	2,695,726	--	48	28,119	8,390,228	15,554,754
3,877,348	177,735	1,076,687	2,189,564	--	1,569	9,929	7,332,832	14,054,841

Table 5.–Log production in the ponderosa pine region by half State and by public and private lands, 1949-70

(Thousand board feet, International 1/4-inch scale)

Year	Eastern Washington				Eastern Oregon				Ponderosa pine region			
	Public	Private	Public percent	Total	Public	Private	Public percent	Total	Public	Private	Public percent	Total
1949	228,453	352,403	39	580,856	513,370	474,077	52	987,447	741,823	826,480	47	1,568,303
1950	327,245	212,931	61	540,176	646,258	516,549	56	1,162,807	973,503	729,480	57	1,702,983
1951	337,193	309,190	52	646,383	670,393	729,906	48	1,400,299	1,007,586	1,039,096	49	2,046,682
1952	322,571	372,953	46	695,524	621,880	595,222	51	1,217,102	944,451	968,175	49	1,912,626
1953	421,019	359,015	54	780,034	667,487	662,183	50	1,329,670	1,088,506	1,021,198	52	2,109,704
1954	382,300	401,890	49	784,190	724,686	797,250	48	1,521,936	1,106,986	1,199,140	48	2,306,126
1955	385,837	425,634	48	811,471	763,114	849,153	47	1,612,267	1,148,951	1,274,787	47	2,423,738
1956	455,045	366,137	55	821,182	897,776	838,736	52	1,736,512	1,352,821	1,204,873	53	2,557,694
1957	423,306	382,710	53	806,016	708,614	752,536	48	1,461,150	1,131,920	1,135,246	50	2,267,166
1958	471,699	354,318	57	826,017	860,103	743,409	54	1,603,512	1,331,802	1,097,727	55	2,429,529
1959	596,775	368,942	62	965,717	1,047,722	793,596	57	1,841,318	1,644,497	1,162,538	59	2,807,035
1960	472,365	424,411	53	896,776	891,642	666,403	57	1,558,045	1,364,007	1,090,814	56	2,454,821
1961	513,912	339,456	60	853,368	925,374	566,048	62	1,491,422	1,439,286	905,504	61	2,344,790
1962	661,674	292,389	69	954,063	991,520	579,719	63	1,571,239	1,653,194	872,108	65	2,525,302
1963	711,717	298,761	70	1,010,478	1,139,338	524,297	68	1,663,635	1,851,055	823,058	69	2,674,113
1964	790,284	318,963	71	1,109,247	1,263,081	583,097	68	1,846,178	2,053,365	902,060	69	2,955,425
1965	837,554	274,806	75	1,112,360	1,370,773	622,995	69	1,993,768	2,208,327	897,801	71	3,106,128
1966	815,616	287,435	74	1,103,051	1,280,237	648,526	66	1,928,763	2,095,853	935,961	69	3,031,814
1967	870,255	268,527	76	1,138,782	1,361,340	501,201	73	1,862,541	2,231,595	769,728	74	3,001,323
1968	948,488	310,784	75	1,259,272	1,417,207	661,064	68	2,078,271	2,365,695	971,848	71	3,337,543
1969	846,629	296,497	74	1,143,126	1,452,944	748,594	66	2,201,538	2,299,573	1,045,091	69	3,344,664
1970	652,502	300,529	68	953,031	1,200,507	708,440	63	1,908,947	1,853,009	1,008,969	65	2,861,978

Table 6.–Log production in the ponderosa pine

(Thousand board feet,

Year	Eastern Washington							
	Private	State	Bureau of Land Management	National Forest	Indian	Other Federal	Other public	Total
1949	352,403	23,935	--	113,325	91,193	--	--	580,856
1950	212,931	73,171	3,333	132,615	118,126	--	--	540,176
1951	309,190	37,998	8,302	156,527	134,366	--	--	646,383
1952	372,953	10,493	1,873	174,515	135,690	--	--	695,524
1953	359,015	37,243	2,078	215,694	166,004	--	--	780,034
1954	401,890	11,702	6,811	220,967	142,820	--	--	784,190
1955	425,634	41,873	9,137	184,851	149,976	--	--	811,471
1956	366,137	34,544	14,779	232,500	173,222	--	--	821,182
1957	382,710	33,571	6,723	243,846	139,166	--	--	806,016
1958	354,318	20,408	10,763	268,347	172,181	--	--	826,017
1959	368,942	23,290	14,924	353,440	205,121	--	--	965,717
1960	424,411	18,562	12,676	291,823	149,304	--	--	896,776
1961	339,456	18,506	10,629	308,650	176,127	--	--	853,368
1962	292,389	34,001	5,760	428,067	193,846	--	--	954,063
1963	298,761	41,982	153	440,760	226,638	--	2,184	1,010,478
1964	318,963	36,230	819	482,106	267,271	3,725	133	1,109,247
1965	274,806	74,137	688	463,406	292,893	5,611	819	1,112,360
1966	287,435	70,272	4,743	458,148	276,234	606	5,613	1,103,051
1967	268,527	77,246	3,642	479,362	300,436	--	9,569	1,138,782
1968	310,784	98,648	4,326	505,620	335,255	4,337	302	1,259,272
1969	296,479	118,004	2,416	456,474	263,896	4,835	1,022	1,143,126
1970	300,529	56,517	3,660	356,163	224,635	2,978	8,549	953,031

region by half State and ownership, 1949-70

International 1/4-inch scale)

Eastern Oregon							Total ponderosa pine region
Private	State	Bureau of Land Management	National Forest	Indian	Other public	Total	
474,077	603	4,835	366,219	141,713	--	987,447	1,568,303
516,549	200	13,046	486,422	146,590	--	1,162,807	1,702,983
729,906	292	56,563	443,408	170,130	--	1,400,299	2,046,682
595,222	129	12,819	480,002	128,930	--	1,217,102	1,912,626
662,183	--	17,030	515,419	135,038	--	1,329,670	2,109,704
797,250	--	18,829	588,821	117,036	--	1,521,936	2,306,126
849,153	--	26,901	593,470	142,743	--	1,612,267	2,423,738
838,736	--	22,795	701,064	173,917	--	1,736,512	2,557,694
752,536	782	24,407	627,448	55,977	--	1,461,150	2,267,166
743,409	2,873	31,637	719,740	105,853	--	1,603,512	2,429,529
793,596	2,006	38,776	925,986	80,954	--	1,841,318	2,807,346
666,403	3,707	52,143	754,534	81,258	--	1,558,045	2,454,821
566,048	2,311	33,598	845,984	43,481	--	1,491,422	2,344,790
579,719	1,477	20,915	912,389	56,739	--	1,571,239	2,525,302
524,297	5,965	22,958	1,034,369	76,046	--	1,663,635	2,674,113
583,097	2,650	24,349	1,139,229	96,853	--	1,846,178	2,955,425
622,995	14,827	12,381	1,264,526	79,039	--	1,993,768	3,106,128
648,526	4,048	45,538	1,166,193	64,458	--	1,928,763	3,031,814
501,201	1,455	29,223	1,213,273	117,389	--	1,862,541	3,001,323
661,064	3,070	42,059	1,265,326	106,752	--	2,078,271	3,337,543
748,594	9,369	28,169	1,317,070	98,335	1	2,201,538	3,344,644
708,440	2,565	24,923	1,089,007	84,012	--	1,908,947	2,861,978

Table 7.–Log production in western Oregon

(Thousand board feet,

Year	Total western Oregon	Benton	Clackamas	Clatsop	Columbia	Coos	Curry	Douglas	Hood River
1925	3,469,865	85,631	94,333	607,024	625,950	394,267	4,804	70,042	[1]/99,264
1926	3,509,226	66,252	129,843	690,863	603,379	372,016	5,751	98,165	[1]/31,611
1927	3,619,063	73,524	186,156	620,175	636,246	352,009	4,828	127,707	[1]/72,722
1928	3,741,380	87,375	184,327	669,915	593,379	360,386	5,733	87,538	[1]/76,119
1929	4,182,563	112,504	205,275	660,102	592,402	408,238	5,655	156,403	[1]/80,090
1930	2,665,515	84,952	174,943	453,422	379,758	166,964	1,322	80,135	[1]/59,529
1931	1,908,525	86,542	110,866	[3]/248,554	310,140	117,244	235	30,647	[1]/51,062
1932	1,291,173	[2]/132,444	57,236	[3]/465,570	(3/)	67,936	1,684	29,713	18,733
1933	1,900,464	[2]/128,992	117,709	[3]/607,609	(3/)	127,859	1,689	53,375	26,507
1934	2,420,259	76,642	147,287	259,098	193,575	445,612	13,133	102,385	29,113
1935	2,721,889	104,485	153,854	[3]/339,161	210,453	258,443	20,737	143,127	[1]/34,199
1936	3,455,321	100,502	202,027	[3]/705,820	(3/)	299,491	45,906	177,330	[1]/99,419
1937	4,074,144	140,912	173,737	639,750	185,840	683,109	40,535	153,646	52,465
1938	3,322,391	127,611	113,608	542,094	198,180	333,090	45,430	169,907	[1]/42,734
1939	4,042,744	120,476	139,335	[3]/544,980	196,644	400,825	90,146	215,958	[1]/98,494
1940	4,682,701	121,275	264,671	[3]/814,959	(3/)	480,879	59,267	297,101	[1]/75,363
1941	6,355,108	194,513	382,843	[3]/624,640	239,603	678,053	80,513	421,598	[1]/93,488
1942	6,320,298	208,100	420,539	[3]/376,384	208,304	544,158	60,489	495,624	65,635
1943	6,705,491	229,241	378,555	[3]/439,221	(3/)	510,720	65,232	617,201	66,750
1945	5,833,305	125,961	316,454	259,009	93,096	349,970	31,141	625,225	48,970
1946	6,559,709	228,108	341,685	243,406	65,351	510,225	26,940	866,689	60,658
1947	8,007,750	253,832	532,325	289,011	86,553	676,672	60,751	1,034,657	49,487
1948	8,694,808	252,845	509,377	252,414	84,340	640,140	146,345	1,369,268	69,230
1949	7,389,496	233,492	442,211	195,675	56,453	526,654	103,682	1,236,719	45,955
1950	8,394,543	235,255	454,217	191,547	65,894	662,521	233,051	1,355,418	60,597
1951	8,938,130	240,025	492,052	213,528	42,099	830,356	344,576	1,606,967	73,176
1952	10,395,523	220,947	489,267	208,642	61,651	895,075	772,567	1,932,281	60,935
1953	8,799,376	210,835	468,527	185,575	80,275	812,311	420,553	1,779,258	78,198
1954	8,931,092	215,675	441,018	159,301	65,258	716,142	477,072	1,892,614	69,872
1955	9,822,650	207,137	503,732	293,040	75,547	912,434	419,781	2,352,083	71,859
1956	9,234,758	237,720	499,782	290,194	143,664	646,369	466,720	2,116,392	79,009
1957	7,397,732	152,612	400,737	209,089	131,074	568,761	530,569	1,556,066	73,745
1958	7,391,604	147,722	428,664	242,235	98,327	690,240	498,923	1,605,117	104,654
1959	8,579,136	159,790	536,647	282,398	96,602	781,997	692,797	1,895,024	113,005
1960	8,245,754	152,485	417,465	305,491	114,702	798,991	559,256	1,821,419	87,897
1961	7,141,832	123,847	370,569	256,281	44,758	521,475	512,824	1,245,096	85,656
1962	8,330,172	101,557	437,465	285,382	44,259	612,627	591,634	1,542,395	88,467
1963	8,399,909	157,085	408,924	287,534	117,336	712,152	583,901	1,498,503	64,145
1964	9,051,042	152,080	402,845	351,566	146,227	858,596	473,588	1,861,767	57,151
1965	8,911,176	144,436	472,416	387,822	123,843	783,259	420,481	1,936,416	68,981
1966	8,418,473	151,420	502,321	316,370	119,517	743,488	427,998	1,734,661	100,739
1967	7,832,007	118,651	429,634	294,513	118,223	568,569	454,301	1,718,017	52,003
1968	9,207,883	115,939	507,851	459,515	131,754	439,842	478,979	2,160,707	43,923
1969	8,390.228	111,661	556,133	334,805	120,819	430,854	485,784	1,965,603	42,635
1970	7,332,832	160,889	392,137	366,021	115,843	641,689	331,432	1,630,095	44,467

NOTE: Production for years 1925–43 and 1945 collected by U.S. Forest Service in cooperation with U.S. Bureau of the Census. Production for 1946 collected by U.S. Forest Service. Production for 1947 and 1948 based on statistics compiled by State Forester, Oregon State Board of Forestry, U.S. Forest Service, and Indian Service. Production statistics for 1944 not available.

Specific data for the following counties and years are unavailable, as combinations were necessary to avoid disclosing

*county, 1925-43 and 1945-70**

rnational 1/4-inch scale)

son	Josephine	Lane	Lincoln	Linn	Marion	Multnomah	Polk	Tillamook	Washington	Yamhill
,369	5,081	315,142	211,430	40,899	144,393	(1/)	171,605	192,022	203,778	129,831
,346	9,590	351,225	173,585	47,369	146,397	69,523	173,024	142,848	183,096	133,343
,791	9,137	396,294	166,668	63,404	142,040	(1/)	183,760	165,437	208,250	142,915
,714	12,891	392,052	157,894	75,256	156,059	(1/)	237,550	181,666	200,718	163,808
,265	22,746	546,819	167,453	79,167	156,463	(1/)	256,874	291,937	183,790	143,380
,481	15,824	361,261	87,906	45,051	126,723	(1/)	176,198	171,322	120,434	70,290
,045	13,042	249,516	51,532	51,142	83,827	(1/)	126,766	4/ 229,522	71,899	22,944
,043	4,556	193,633	(4/)	20,012	66,663	18,920	(2/)	4/ 100,591	46,699	42,740
,810	18,876	269,005	91,718	59,693	74,449	31,492	(2/)	62,358	141,447	40,876
,651	24,312	272,723	122,725	95,844	120,338	51,527	94,748	159,264	123,996	48,286
,377	29,188	382,235	139,124	95,948	110,626	35,976	108,851	262,797	178,166	57,142
,375	39,250	502,937	159,756	139,798	122,029	(1/)	174,853	238,836	301,868	49,124
,967	42,288	540,315	182,165	205,405	109,790	29,646	178,883	340,734	192,273	43,684
,251	25,407	486,583	121,025	135,662	70,680	20,299	197,780	389,670	140,893	57,487
,370	17,835	694,470	273,738	215,085	82,568	(1/)	236,881	270,613	237,535	53,791
,518	30,130	741,408	279,716	352,565	100,533	46,226	187,612	426,090	177,106	72,282
,598	67,086	885,249	314,147	594,878	157,130	(1/)	386,880	487,335	239,469	133,085
,415	129,232	967,891	381,966	697,562	220,387	2,722	310,238	557,792	247,390	85,470
,827	158,203	1,158,634	435,237	879,483	154,582	3,145	354,841	513,906	215,550	113,163
,712	158,956	1,314,615	323,633	928,104	153,343	7,450	288,129	238,063	128,537	91,937
,894	197,582	1,296,395	455,776	785,641	107,277	2,629	323,416	366,839	137,029	134,169
,879	238,244	1,465,398	485,064	918,778	165,655	18,555	366,970	506,672	162,747	202,500
,850	303,792	1,505,403	565,364	809,508	191,604	9,756	306,029	628,090	157,320	181,133
,013	230,716	1,212,021	436,938	678,405	133,017	14,433	288,454	793,215	195,341	134,102
,074	298,812	1,542,038	321,017	695,270	168,264	25,512	296,822	870,926	149,318	155,990
,387	383,070	1,712,184	227,398	664,166	167,121	20,823	283,140	740,107	121,591	134,364
,595	380,376	1,844,792	664,262	712,018	147,540	24,507	258,888	735,077	159,422	149,681
,507	293,917	1,566,296	524,985	647,647	195,282	15,940	156,051	593,949	167,755	57,515
,562	334,705	1,500,367	488,646	645,001	129,574	21,164	235,944	524,611	124,691	87,875
,245	352,223	1,461,200	736,367	576,772	85,370	16,239	231,243	488,367	102,576	88,435
,644	318,981	1,322,584	690,480	662,870	96,215	22,029	264,644	498,378	113,767	94,316
,679	234,074	1,159,050	572,694	575,858	53,310	10,675	168,833	342,443	80,654	61,809
,023	137,239	1,317,799	384,832	463,291	107,254	10,116	169,944	331,869	50,082	72,273
,245	241,587	1,307,333	512,455	553,231	134,255	20,187	212,193	322,009	45,217	68,164
,295	190,495	1,561,187	522,901	496,023	123,371	34,183	93,227	351,860	28,124	47,382
,787	161,772	1,761,152	381,717	653,615	127,232	36,383	63,179	243,900	12,112	42,477
,438	241,849	2,038,464	466,222	738,345	127,978	41,222	102,955	274,270	28,384	36,259
,401	213,218	1,856,327	516,899	740,298	161,955	34,789	184,918	279,197	30,598	24,729
,437	212,075	1,968,662	564,048	739,685	147,640	55,925	151,756	284,845	23,368	53,781
,581	166,854	1,818,337	530,264	842,005	151,592	53,125	131,543	280,780	35,654	46,787
,757	167,922	1,662,920	515,871	818,866	104,591	48,664	116,337	252,303	33,587	64,141
,143	177,588	1,558,551	503,827	761,646	83,302	26,905	73,575	297,220	20,224	69,115
,726	168,821	1,885,027	543,927	837,490	170,255	83,752	114,088	310,813	37,621	70,853
,022	162,871	1,720,317	415,777	794,187	141,251	51,740	115,925	298,257	48,561	63,026
,010	139,526	1,532,042	271,399	711,847	140,602	63,852	100,601	251,113	24,665	44,602

duction of individual operations:

1/ Hood River and Multnomah - 1925, 1927-31, 1936, 1939, and 1941.
2/ Benton and Polk - 1932 and 1933.
3/ Clatsop and Columbia - 1932, 1933, 1936, 1940, and 1943.
4/ Lincoln and Tillamook - 1932.

Table 8.–Log production in eastern Oregon

(Thousand board feet,

Year	Total eastern Oregon	Baker	Crook	Deschutes	Gilliam	Grant	Harney	Jefferson
1925	1,024,492	58,802	(1/)	1/ 366,020	--	23,808	1,070	(2/)
1926	1,038,374	61,723	(1/)	1/ 332,208	--	31,388	829	(2/)
1927	809,724	42,934	(1/)	1/ 252,414	--	21,357	877	(2/)
1928	966,804	28,767	(1/)	1/ 312,622	--	22,160	979	(2/)
1929	1,139,079	29,243	(1/)	1/ 339,885	--	31,822	1,316	(2/)
1930	929,001	35,412	(1/)	1/ 243,050	--	68,186	4,093	(2/)
1931	723,342	34,978	(1/)	1/ 171,842	--	55,276	5,842	(2/)
1932	420,804	27,954	(1/)	1/ 91,752	--	44,635	663	(2/)
1933	676,047	49,942	(1/)	1/ 147,318	--	50,236	407	(2/)
1934	659,778	39,221	(1/)	1/ 145,777	--	42,137	369	(2/)
1935	1,085,986	51,515	(1/)	1/ 169,391	--	3/ 115,154	2,953	7,094
1936	1,298,002	57,593	5,195	192,686	--	3/ 132,391	567	14,338
1937	1,419,927	52,262	13,000	222,872	--	3/ 158,387	(3/)	23,428
1938	1,098,930	23,903	41,462	200,657	--	3/ 82,682	(3/)	(2/)
1939	1,578,591	50,780	83,416	211,026	--	3/ 177,390	(3/)	(2/)
1940	1,582,616	45,508	93,994	258,050	--	3/ 164,542	(3/)	(2/)
1941	1,710,851	73,905	109,097	196,672	--	3/ 155,989	(3/)	(2/)
1942	1,812,359	47,601	105,395	248,334	--	3/ 142,203	(3/)	(2/)
1943	1,595,415	72,351	60,278	200,743	--	139,235	1,032	35,952
1945	1,145,094	28,159	79,915	1/ 133,733	--	4/ 145,015	1,700	8,239
1946	1,342,652	35,969	(1/)	1/ 194,605	--	4/ 188,653	3,836	54,777
1947	1,354,696	32,266	85,054	14,619	--	181,362	30,284	170,618
1948	1,274,344	28,314	97,922	47,918	--	188,479	51,799	137,020
1949	987,447	11,847	89,317	33,289	--	165,142	45,261	120,424
1950	1,162,807	15,803	60,766	42,499	--	196,769	27,392	43,670
1951	1,400,299	28,804	102,543	52,773	2,789	229,803	48,199	115,532
1952	1,217,102	40,617	72,291	62,126	--	248,890	32,079	83,291
1953	1,329,670	57,234	66,632	58,779	--	212,983	27,974	83,173
1954	1,521,936	76,541	93,334	74,814	535	261,679	51,999	59,510
1955	1,612,267	82,426	59,938	51,556	--	301,470	47,132	104,708
1956	1,736,512	106,198	87,440	90,096	--	304,811	61,653	107,430
1957	1,461,150	94,903	60,292	92,044	--	225,916	25,883	61,837
1958	1,603,512	102,234	86,023	96,738	--	257,137	49,753	81,875
1959	1,841,318	125,816	87,784	96,985	--	291,856	43,767	95,927
1960	1,558,045	65,569	61,163	82,308	--	192,505	55,255	50,194
1961	1,491,422	46,130	80,250	96,421	45	223,737	47,338	54,200
1962	1,571,239	76,289	122,923	77,991	--	185,606	53,622	61,642
1963	1,663,635	69,499	101,019	64,051	--	290,942	29,898	84,197
1964	1,846,178	118,380	110,624	121,318	--	287,061	62,135	98,837
1965	1,993,768	116,651	73,133	140,502	--	270,691	83,461	107,444
1966	1,928,763	123,336	82,149	137,478	--	225,720	76,395	41,822
1967	1,862,541	102,919	99,294	150,535	--	278,809	76,539	53,969
1968	2,078,271	118,382	102,241	74,136	428	253,537	68,249	111,553
1969	2,201,538	109,752	90,636	97,940	2,632	260,561	66,488	136,284
1970	1,908,947	71,150	109,140	99,450	--	251,056	64,414	109,572

NOTE: Production for years 1925-43 and 1945 collected by U.S. Forest Service in cooperation with U.S. Bureau of the Census. Production for 1946 collected by U.S. Forest Service. Production for 1947 and 1948 based on statistics compiled by State Forester, Oregon State Board of Forestry, U.S. Forest Service, and Indian Service. Production statistics for 1944 not available.

Specific data for the following counties and years are unavailable, as combinations were necessary to

*by county, 1925-43 and 1945-70**

International 1/4-inch scale)

Klamath	Lake	Malheur	Morrow	Umatilla	Union	Wallowa	Wasco	Wheeler
405,987	5,072	374	(5/)	5/ 13,658	28,077	119,856	2/ 987	781
433,682	10,219	268	(5/)	5/ 1,134	61,418	103,151	2/ 1,728	626
368,770	12,027	--	(5/)	5/ 770	44,887	63,606	2/ 1,215	867
484,999	21,470	--	(5/)	5/ 1,140	52,574	35,272	2/ 1,519	5,302
547,733	30,559	214	(5/)	5/ 8,448	77,832	46,470	995	24,562
443,889	14,365	-	(5/)	5/ 9,780	42,238	40,714	2/ 1,610	25,664
371,044	7,918	--	(5/)	5/ 13,295	23,465	6/ 12,482	2/ 1,418	25,782
196,591	20,330	161	(5/)	3,568	(6/)	12,530	2/ 1,375	21,245
304,586	51,750	268	856	5/ 3,087	25,418	7,709	2/ 11,112	23,358
318,448	49,974	1,231	(5/)	5/ 6,944	13,760	6,452	2/ 13,669	21,796
495,480	129,888	696	(5/)	10,459	45,850	17,339	6,120	34,047
616,304	137,190	2,488	2,846	5/ 10,111	58,246	24,075	10,197	33,775
657,927	139,571	2,932	(5/)	14,743	47,005	38,982	8,515	40,303
462,513	140,748	2,247	4,799	17,366	56,522	24,337	2/ 9,219	32,475
641,797	211,574	2,247	7,084	15,856	49,445	42,169	2/ 43,880	41,927
678,267	129,429	3,210	11,466	28,543	45,265	35,382	2/ 43,980	44,980
646,361	275,626	1,252	15,579	35,064	56,785	45,839	2/ 15,438	83,244
740,239	210,469	--	32,419	52,778	68,582	50,301	2/ 26,106	87,932
548,332	287,357	.	28,302	64,352	42,634	36,229	8,490	70,128
477,765	72,401	--	11,630	40,364	28,626	36,894	25,013	55,640
432,479	136,718	(4/)	41,323	63,506	46,402	46,134	47,575	50,675
403,892	95,502	1,027	25,260	47,856	42,590	64,277	89,854	70,235
342,726	89,942	321	36,867	51,675	27,525	72,170	71,958	29,708
284,525	42,923	--	34,078	11,292	24,523	49,348	60,571	14,907
290,937	86,756	--	29,813	57,316	42,121	62,320	100,767	105,878
261,280	102,345	--	30,672	65,174	40,665	63,617	134,785	121,318
211,155	124,227	--	12,005	43,370	51,946	58,639	110,788	65,678
231,156	158,625	428	11,609	68,021	51,652	73,350	107,007	121,047
207,298	134,430	5,510	26,516	108,999	69,470	115,859	113,327	122,115
321,676	156,622	599	39,740	84,159	62,175	85,499	129,403	85,164
198,205	252,831	137	54,067	83,488	95,474	93,786	124,298	76,598
194,731	163,966	--	62,355	87,768	129,083	106,609	133,775	21,988
217,700	168,347	--	67,980	98,969	105,373	94,510	129,379	47,494
264,698	185,079	2,311	78,543	119,871	117,882	111,173	126,038	93,588
260,592	213,143	535	74,478	98,676	86,945	102,309	167,421	46,952
194,948	183,327	1,318	44,890	121,561	124,966	98,496	132,151	41,644
266,125	178,746	--	47,571	154,600	122,816	88,728	105,553	29,027
292,344	184,778	107	24,905	112,405	122,521	146,885	118,536	21,548
310,178	276,924	--	31,583	81,473	105,018	103,331	101,909	37,407
447,199	184,648	1,284	29,173	99,998	132,140	138,370	113,977	55,097
454,290	276,509	2,675	45,288	120,588	95,994	108,363	112,770	25,386
300,011	255,178	161	39,715	68,540	119,660	141,645	157,260	18,306
426,385	423,860	125	24,860	78,379	86,215	164,646	93,090	52,185
516,505	344,416	379	10,569	97,205	110,953	176,223	137,294	43,701
460,323	277,445	4	30,464	48,242	139,400	99,116	110,653	38,518

avoid disclosing production of individual operations:

1/ Crook and Deschutes - 1925-35 and 1946.
2/ Jefferson and Wasco - 1925-34 and 1938-42.
3/ Grant and Harney - 1937-42.
4/ Grant and Malheur - 1946.
5/ Morrow and Umatilla - 1925-32, 1934, 1935, and 1937.
6/ Union and Wallowa - 1932.

Table 9.–Log production in western Washington

(Thousand board feet,

Year	Total western Washington	Clallam	Clark	Cowlitz	Grays Harbor	Island	Jefferson	King	Kitsap
1925	7,200,629	389,371	50,012	360,814	1,954,919	1/ 1,937	114,014	817,577	83,918
1926	7,146,917	450,996	75,769	541,098	1,916,244	1/ 1,388	127,526	752,014	100,422
1927	7,693,903	583,353	71,297	559,411	2,069,400	1/ 2,806	187,960	763,926	132,729
1928	8,059,434	700,146	71,979	547,103	1,900,394	1/ 2,321	180,705	770,386	235,748
1929	8,242,237	791,016	81,376	588,122	2,089,491	1/ 2,960	240,857	726,771	160,792
1930	5,237,971	584,341	27,622	684,622	1,035,334	1/ 1,219	97,405	444,979	140,589
1931	3,900,006	409,429	2,369	561,608	695,291	1/ 1,890	102,077	289,037	139,233
1932	2,465,136	248,921	4,490	454,381	451,509	1/ 827	88,920	131,883	110,561
1933	3,855,553	447,202	18,294	643,997	636,106	1/ 2,313	69,037	223,715	150,535
1934	4,074,210	418,124	28,562	519,722	808,979	1/ 16,425	87,790	254,696	123,218
1935	4,046,103	395,116	22,433	514,270	522,906	1/ 1,280	67,091	300,671	124,107
1936	5,576,740	527,342	34,632	594,830	900,596	1/ 72	58,808	510,993	117,498
1937	5,625,499	543,915	34,648	547,616	844,111	2,677	123,056	384,638	49,314
1938	3,665,501	258,795	8,868	459,888	424,714	1/ 1,201	30,607	293,838	120,978
1939	4,857,976	218,758	8,366	377,780	589,295	1/ 1,257	88,249	380,054	40,764
1940	5,456,132	461,289	15,197	343,466	649,341	1/ 1,435	41,984	405,399	24,951
1941	5,611,924	478,792	21,989	357,760	689,501	1/ 2,091	71,273	328,930	13,757
1942	5,334,166	406,116	14,997	240,183	500,096	1/ 3,611	66,092	366,904	14,218
1943	5,015,083	324,816	42,350	393,639	458,754	1/ 2,485	114,672	393,898	19,691
1945	3,596,002	282,906	23,486	262,799	357,486	4,334	42,878	342,912	9,993
1946	4,058,780	283,182	44,737	236,749	508,068	6,321	57,008	293,658	12,247
1948	4,241,400	404,235	26,541	259,884	457,276	9,526	148,595	263,194	14,719
1949	3,992,336	279,072	27,063	313,393	424,027	14,708	56,291	290,349	50,406
1950	4,770,202	280,417	89,757	265,258	567,291	19,578	137,116	229,758	83,609
1951	4,980,868	277,394	52,703	373,256	561,780	24,587	199,101	257,818	109,074
1952	4,324,531	324,888	31,707	345,018	511,325	29,564	213,551	296,026	71,858
1953	4,454,180	406,805	16,606	530,971	429,741	24,344	112,828	240,835	33,536
1954	4,000,717	397,655	51,456	419,312	434,823	20,435	130,451	239,499	29,831
1955	4,697,883	386,833	48,813	530,708	485,009	27,291	260,824	306,200	33,320
1956	5,150,674	291,343	40,638	534,001	534,067	16,280	231,873	371,542	65,409
1957	3,978,225	246,047	20,328	485,767	370,224	25,602	218,893	284,477	43,183
1958	3,750,289	200,182	16,725	462,435	418,786	18,416	197,809	273,199	30,386
1959	4,786,576	333,206	22,815	427,347	541,244	22,084	269,037	233,096	43,024
1960	4,693,611	342,320	13,293	581,927	529,680	26,140	260,583	370,617	33,850
1961	4,391,280	311,503	41,865	493,166	474,871	20,818	279,361	257,564	34,728
1962	5,020,754	277,947	90,577	497,681	498,870	15,132	295,288	299,778	25,492
1963	5,411,281	401,817	39,617	699,565	578,673	20,245	332,054	293,164	22,917
1964	6,281,882	377,674	18,255	855,362	724,534	15,761	382,732	476,277	26,306
1965	6,616,986	392,251	45,047	867,250	762,672	12,026	392,431	407,923	23,936
1966	6,088,866	342,419	42,305	643,182	653,078	15,890	454,944	334,762	20,169
1967	5,880,426	406,220	18,985	533,699	624,295	11,855	445,764	419,723	22,380
1968	6,993,222	468,188	37,855	749,678	751,626	13,025	513,241	420,649	26,182
1969	7,164,526	432,859	64,884	640,957	856,105	17,367	504,608	500,053	28,954
1970	6,722,009	428,764	28,135	759,197	687,900	18,945	452,615	557,159	35,115

NOTE: Production for years 1925-43 and 1945 collected by U.S. Forest Service in cooperation with U.S. Bureau of the Census. Production for 1946 and 1948 collected by U.S. Forest Service. Production statistics for 1944 and 1947 not available.

Specific data for the following counties and years are unavailable, as combinations were necessary to avoid

*y county, 1925-43, 1945, 1946, and 1948-70**

nternational 1/4-inch scale)

Lewis	Mason	Pacific	Pierce	San Juan	Skagit	Skamania	Snohomish	Thurston	Wahkiakum	Whatcom
566,059	243,355	2/337,297	549,264	(1/)	496,536	31,213	738,091	200,495	94,707	171,050
493,444	258,475	2/506,368	550,537	(1/)	450,002	35,504	572,200	170,573	(2/)	144,357
554,964	374,153	311,673	561,569	(1/)	469,335	26,693	450,561	277,453	137,507	159,113
574,146	616,009	337,283	554,568	(1/)	515,620	32,734	428,881	298,738	166,566	126,107
566,824	609,943	389,990	543,150	(1/)	399,787	41,243	367,936	351,919	163,114	126,946
435,486	270,290	2/342,951	484,212	(1/)	86,494	27,695	188,642	333,851	(2/)	52,239
370,711	179,116	2/298,928	295-883	(1/)	132,164	27,109	96,666	252,363	(2/)	46,132
105,981	91,921	2/238,038	188,720	(1/)	53,281	16,946	101,418	157,248	(2/)	20,091
273,868	81,941	296,712	274,753	(1/)	51,097	21,014	314,929	199,429	92,343	58,268
301,163	124,414	219,038	294,300	(1/)	161,235	17,593	257,188	290,846	79,547	71,370
536,197	163,874	291,599	298,523	--	181,367	22,868	211,170	240,396	79,184	73,051
961,831	213,305	2/332,829	348,440	(1/)	272,268	31,060	210,157	228,484	118,199	115,396
1,041,687	232,196	2/460,936	510,763	--	303,938	46,106	259,398	138,280	(2/)	102,220
817,314	147,591	2/258,363	304,475	--	113,206	40,222	171,563	179,628	(2/)	34,250
1,268,721	292,479	2/469,443	360,143	(1/)	267,436	68,454	235,695	61,103	(2/)	129,979
1,366,466	248,530	2/561,417	407,063	(1/)	348,676	51,376	282,584	72,933	(2/)	174,025
1,618,283	210,850	389,861	448,540	(1/)	358,419	77,483	222,728	37,818	94,216	189,633
1,667,302	200,451	2/489,432	324,251	(1/)	373,093	83,853	214,379	30,669	105,737	232,782
1,174,832	180,106	2/582,975	362,851	(1/)	313,977	93,037	256,403	35,904	(2/)	264,693
759,316	116,024	2/419,167	190,609	--	255,067	104,798	201,818	73,529	(2/)	148,880
863,965	168,294	525,174	214,051	5,328	207,382	108,520	183,073	102,675	80,249	158,099
814,842	37,733	649,693	217,634	990	256,440	147,270	170,294	118,125	64,671	179,738
722,613	131,418	411,916	203,511	20,076	212,046	222,589	198,379	167,372	64,706	182,401
832,443	180,081	548,087	260,058	24,911	263,828	239,638	252,752	158,141	78,853	258,626
1,012,982	141,139	540,476	239,966	22,887	249,813	263,600	240,912	130,769	84,880	197,731
707,978	119,724	249,420	281,606	21,226	190,030	242,040	264,922	149,856	92,711	181,081
879,707	129,996	495,263	200,292	18,092	182,262	187,260	223,935	71,742	77,451	192,514
693,376	121,740	253,349	209,389	16,589	129,646	278,895	198,868	117,501	67,885	190,017
673,280	121,372	394,789	277,039	19,728	211,965	324,005	211,032	142,385	76,999	166,291
687,193	185,717	475,029	316,009	32,812	152,648	372,131	249,660	182,692	209,182	202,448
543,683	183,932	275,787	230,164	8,591	148,488	371,360	170,170	106,183	68,167	177,179
593,805	171,430	261,493	208,965	6,348	141,068	328,855	149,357	74,637	78,348	118,045
729,075	197,888	305,498	385,411	10,994	203,874	416,548	261,598	79,743	112,460	191,634
583,084	197,364	285,842	312,602	9,498	215,335	317,151	268,417	56,885	151,441	137,582
483,070	151,819	394,954	329,746	6,756	160,105	411,406	248,048	48,934	115,451	127,115
658,032	168,749	463,614	380,689	6,748	174,415	519,117	317,264	60,565	123,499	147,297
668,617	158,513	513,662	390,008	4,625	166,072	403,737	385,872	95,946	60,245	175,932
878,494	215,249	534,995	421,457	5,125	237,855	423,238	263,091	163,461	62,665	199,351
996,738	220,714	604,791	329,015	5,649	249,003	460,018	415,206	89,792	127,683	214,841
928,109	215,028	532,822	446,796	3,201	222,198	508,398	277,145	141,293	126,346	180,781
894,604	173,128	475,231	416,836	1,744	252,983	537,361	259,206	88,776	125,151	172,485
1,030,720	208,646	692,625	430,033	4,135	296,625	662,935	267,238	115,215	128,306	176,300
964,771	203,643	650,878	496,315	2,263	366,578	505,680	471,651	142,778	143,746	170,436
893,220	209,871	718,664	461,656	2,156	348,179	481,130	289,133	101,396	124,532	124,242

sclosing production of individual operations:

1/ Island and San Juan - 1925-34, 1936, and 1939-43. Presence of footnote reference indicates year in which there was oduction.

2/ Pacific and Wahkiakum - 1926, 1930-32, 1937-40, 1943, and 1945.

Table 10.–Log production in eastern Washingto

(Thousand board feet

Year	Total eastern Washington	Asotin	Chelan	Columbia	Douglas	Ferry	Garfield	Kittitas	Klickitat
1925	500,592	(1/)	73,012	1/4,778	--	30,730	--	80,068	61,284
1926	544,946	(1/)	55,940	1/4,494	--	35,203	--	78,131	72,252
1927	454,810	(1/)	37,568	1/3,531	--	21,662	--	48,883	51,611
1928	500,044	(1/)	31,945	1/4,965	--	27,194	--	82,615	58,823
1929	594,395	(1/)	38,092	1/7,169	--	41,927	--	87,312	89,359
1930	446,088	(1/)	29,762	1/2,177	--	32,330	--	80,619	45,256
1931	369,487	(1/)	40,505	1/1,819	--	21,651	--	76,794	44,368
1932	235,341	--	33,154	1/1,070	--	14,648	--	59,283	34,459
1933	319,609	(1/)	41,077	1/2,723	--	22,572	--	57,903	43,988
1934	330,400	(1/)	42,484	1/4,515	--	29,254	--	47,647	45,561
1935	383,467	(1/)	45,710	1/6,848	--	23,513	--	63,119	59,851
1936	433,714	(1/)	42,511	1/4,847	--	12,113	(1/)	65,917	78,886
1937	476,751	(1/)	48,532	1/8,068	--	19,058	--	59,408	79,807
1938	370,847	--	47,769	1/3,542	--	19,039	(1/)	31,479	57,953
1939	445,065	(1/)	48,283	1/7,059	--	23,500	(1/)	50,947	73,727
1940	495,882	(1/)	52,326	1/6,688	--	31,820	(1/)	49,926	101,265
1941	529,152	--	68,565	1/6,162	--	15,254	(1/)	67,737	111,113
1942	545,818	(1/)	66,095	1/4,767	--	37,205	--	73,799	109,127
1943	511,724	(1/)	55,297	1/2,793	--	23,330	(1/)	88,284	93,396
1945	432,841	(1/)	48,848	1/3,470	--	26,599	--	43,351	103,858
1946	498,865	(1/)	44,870	1/3,058	--	12,999	(1/)	60,887	137,692
1948	640,360	(1/)	42,789	1/8,563	--	47,168	(1/)	54,932	86,113
1949	580,856	19,495	47,325	374	--	46,845	1,391	72,315	91,419
1950	540,176	13,485	57,853	--	--	75,583	1,270	69,345	71,921
1951	646,383	9,621	46,800	235	--	73,968	1,327	70,469	104,182
1952	695,524	6,742	41,056	1,842	--	96,041	5,686	79,332	137,754
1953	780,034	12,949	52,802	535	--	95,564	2,827	80,141	156,759
1954	784,190	7,969	46,902	7,958	--	107,593	570	86,202	145,610
1955	811,471	4,179	55,538	6,891	--	116,358	3,150	105,765	130,097
1956	821,182	3,386	68,903	7,558	--	102,397	668	63,467	124,596
1957	806,016	2,976	68,514	11,040	--	111,871	2,436	82,670	141,362
1958	826,017	6,306	62,927	26,410	16	123,696	948	94,776	117,127
1959	965,717	6,937	80,712	21,444	41	152,915	7,814	132,059	85,588
1960	896,776	7,155	74,545	13,400	--	123,717	8,344	149,564	96,597
1961	853,368	2,500	75,277	21,646	1,340	111,172	6,298	138,058	67,736
1962	954,063	26,587	84,597	13,971	498	150,075	8,614	126,240	62,017
1963	1,010,478	3,542	96,504	11,718	--	158,720	15,795	118,394	68,825
1964	1,109,247	6,973	96,626	7,852	--	156,365	22,674	166,759	58,201
1965	1,112,360	5,945	102,803	10,352	--	177,061	11,918	156,140	84,807
1966	1,103,051	5,702	96,646	13,787	--	164,712	8,822	123,385	75,715
1967	1,138,782	1,665	84,333	18,280	--	163,931	14,019	109,329	87,858
1968	1,259,272	7,063	91,483	14,446	--	193,360	9,009	150,489	87,427
1969	1,143,126	9,651	98,839	18,779	--	146,133	15,855	97,766	85,516
1970	953,031	9,573	65,491	12,251	--	144,344	16,996	87,627	77,184

NOTE: Production for years 1925-43 and 1945 collected by U.S. Forest Service in cooperation with U.S. Bureau of the Census Production for 1946 and 1948 collected by U.S. Forest Service. Production statistics for 1944 and 1947 not available.

Specific data for the following counties and years are unavailable, as combinations were necessary to avoid disclosing

*by county, 1925-43, 1945, 1946, and 1948-70**

International 1/4-inch scale)

Lincoln	Okanogan	Pend Oreille	Spokane	Stevens	Walla Walla	Whitman	Yakima
(2/)	42,816	50,091	2/ 72,714	82,189	--	--	2,910
(2/)	49,445	65,666	2/ 80,002	101,887	--	--	1,926
(2/)	50,879	73,520	2/ 67,169	94,209	--	--	5,778
(2/)	69,438	67,718	2/ 56,382	97,968	--	--	2,996
(2/)	85,279	65,995	2/ 70,936	103,725	--	(1/)	4,601
(2/)	63,349	70,754	2/ 47,235	72,519	--	(1/)	2,087
(2/)	58,513	49,102	2/ 32,244	41,976	--	--	2,515
--	38,344	23,353	13,680	14,996	--	--	2,354
--	60,963	42,607	2/ 24,236	20,822	--	--	2,718
(2/)	50,964	33,261	2/ 37,022	32,512	--	(1/)	7,180
(2/)	70,818	31,817	2/ 25,728	38,483	--	--	17,580
(2/)	73,889	39,622	2/ 30,313	59,037	--	--	26,579
(2/)	87,571	58,087	2/ 28,908	56,478	--	--	30,834
(2/)	69,049	41,317	2/ 25,814	46,118	--	--	28,767
(2/)	82,310	51,957	2/ 18,763	52,454	--	--	36,065
--	101,462	40,463	8,330	49,383	(1/)	--	54,219
--	118,156	22,138	17,994	60,491	(1/)	--	41,542
--	125,967	28,281	13,398	49,007	(1/)	--	38,172
--	105,908	35,611	5,520	52,046	--	--	49,539
--	73,525	20,889	2/ 12,676	41,519	--	--	58,106
(2/)	76,444	20,446	2/ 13,358	88,366	(1/)	--	40,745
(2/)	90,948	63,625	2/ 22,108	139,236	(1/)	(1/)	84,878
107	104,584	32,544	3,201	63,001	5,071	--	93,184
1,616	110,089	38,539	11,735	14,068	3,210	--	71,462
6,307	110,191	33,689	15,922	86,566	176	--	86,930
5,672	99,314	32,988	16,877	76,043	--	--	96,177
6,105	124,164	26,128	17,713	80,799	--	--	123,548
3,165	131,968	27,441	20,373	95,403	3,210	659	99,167
991	128,366	42,524	20,063	105,410	984	--	91,155
4,026	126,075	63,720	22,346	123,679	2,151	--	108,210
5,911	112,252	39,370	17,034	97,017	10,363	284	102,916
4,173	110,564	56,113	12,981	96,606	9,109	--	104,265
3,372	145,387	69,917	19,590	111,083	10,102	--	118,756
3,344	138,265	41,973	20,518	106,119	4,772	182	108,281
3,596	103,800	66,849	16,318	85,848	5,970	--	146,960
1,338	129,528	71,294	15,398	80,898	6,378	70	176,560
1,601	130,969	90,297	11,524	94,304	15,124	123	193,038
164	160,567	89,482	11,532	109,367	7,769	--	214,916
220	160,055	63,088	13,580	95,711	7,363	--	223,317
2,192	179,022	90,402	15,041	91,166	5,956	374	230,129
48	202,392	90,449	10,094	95,858	3,195	--	257,331
568	200,874	96,800	15,539	124,283	7,957	--	259,974
5,499	179,456	97,182	17,931	101,366	896	107	268,150
827	110,517	79,440	20,158	93,370	4,534	1	230,718

production of individual operations:

1/ Asotin, Columbia, Garfield, Walla Walla, and Whitman - 1925-48. Presence of footnote reference indicates year in which there was production.

2/ Lincoln and Spokane - 1925-31, 1934-39, 1946, and 1948.

Table 11.–Log production by ownership and county in the State of Washington, 1949[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State	Bureau of Land Management[3]	National Forest	Indian	Other Federal	Total
Western Washington:							
Clallam	203,460	5,825	--	30,537	39,250	--	279,072
Clark	26,596	226	--	241	--	--	27,063
Cowlitz	312,262	839	292	--	--	--	313,393
Grays Harbor	243,874	--	--	125,890	54,263	--	424,027
Island	14,708	--	--	--	--	--	14,708
Jefferson	36,172	--	--	19,916	203	--	56,291
King	281,258	--	111	8,811	169	--	290,349
Kitsap	50,406	--	--	--	--	--	50,406
Lewis	661,263	4,017	--	57,333	--	--	722,613
Mason	130,332	--	--	1,086	--	--	131,418
Pacific	408,686	3,230	--	--	--	--	411,916
Pierce	184,561	--	--	18,950	--	--	203,511
San Juan	20,076	--	--	--	--	--	20,076
Skagit	166,912	760	281	41,521	2,572	--	212,046
Skamania	117,369	1,780	--	103,440	--	--	222,589
Snohomish	145,478	30	--	50,935	1,936	--	198,379
Thurston	167,372	--	--	--	--	--	167,372
Wahkiakum	61,058	3,648	--	--	--	--	64,706
Whatcom	128,315	805	--	51,177	2,104	--	182,401
Total	3,360,158	21,160	684	509,837	100,497	--	3,992,336
Eastern Washington:							
Adams	--	--	--	--	--	--	--
Asotin	19,388	--	--	107	--	--	19,495
Benton	--	--	--	--	--	--	--
Chelan	24,509	239	--	22,577	--	--	47,325
Columbia	374	--	--	--	--	--	374
Douglas	--	--	--	--	--	--	--
Ferry	12,202	--	--	11,456	23,187	--	46,845
Franklin	--	--	--	--	--	--	--
Garfield	1,284	--	--	107	--	--	1,391
Grant	--	--	--	--	--	--	--
Kittitas	58,619	--	--	13,696	--	--	72,315
Klickitat	86,548	4,871	--	--	--	--	91,419
Lincoln	107	--	--	--	--	--	107
Okanogan	10,715	10,281	--	37,236	46,352	--	104,584
Pend Oreille	15,377	--	--	17,167	--	--	32,544
Spokane	--	3,201	--	--	--	--	3,201
Stevens	52,474	272	--	1,349	8,906	--	63,001
Walla Walla	5,071	--	--	--	--	--	5,071
Whitman	--	--	--	--	--	--	--
Yakima	65,735	5,071	--	9,630	12,748	--	93,184
Total	352,403	23,935	--	113,325	91,193	--	580,856
Total Washington	3,712,561	45,095	684	623,162	191,690	--	4,573,192

1/ Includes volume removed as logs, poles, piling, cordwood, shingle bolts, etc., as compiled by the State Division of Forestry, except as noted.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands other than those for wh timber sales were reported by the Commissioner of Public Lands.

3/ Based on Timber Sale Summary for BLM.

Table 12.–Log production by ownership and county in the State of Washington, 1950[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State	Bureau of Land Management[3]	National Forest	Indian	Other Federal	Total
Western Washington:							
Clallam	159,223	19,407	1,642	63,730	36,415	--	280,417
Clark	81,885	7,872	--	--	--	--	89,757
Cowlitz	169,635	95,623	--	--	--	--	265,258
Grays Harbor	314,714	10,789	--	179,964	61,824	--	567,291
Island	19,578	--	--	--	--	--	19,578
Jefferson	113,777	5,837	--	17,502	--	--	137,116
King	201,012	6,932	--	21,605	209	--	229,758
Kitsap	82,756	--	--	--	853	--	83,609
Lewis	739,317	16,173	3,085	73,868	--	--	832,443
Mason	167,995	9,096	--	2,776	214	--	180,081
Pacific	440,903	107,184	--	--	--	--	548,087
Pierce	227,952	--	--	32,106	--	--	260,058
San Juan	24,911	--	--	--	--	--	24,911
Skagit	215,923	15,356	1,338	28,968	2,243	--	263,828
Skamania	128,064	8,013	--	103,561	--	--	239,638
Snohomish	147,909	11,610	--	89,077	4,156	--	252,752
Thurston	153,339	4,602	--	--	200	--	158,141
Wahkiakum	75,224	3,182	447	--	--	--	78,853
Whatcom	174,565	8,844	993	72,299	1,925	--	258,626
Total	3,638,682	330,520	7,505	685,456	108,039	--	4,770,202
Eastern Washington:							
Adams	--	--	--	--	--	--	--
Asotin	11,919	1,566	--	--	--	--	13,485
Benton	--	--	--	--	--	--	--
Chelan	21,225	3,137	--	33,491	--	--	57,853
Columbia	--	--	--	--	--	--	--
Douglas	--	--	--	--	--	--	--
Ferry	4,871	7,191	1,284	18,124	44,113	--	75,583
Franklin	--	--	--	--	--	--	--
Garfield	1,163	--	--	107	--	--	1,270
Grant	--	--	--	--	--	--	--
Kittitas	39,701	20,014	--	9,630	--	--	69,345
Klickitat	48,197	18,946	--	--	4,778	--	71,921
Lincoln	786	830	--	--	--	--	1,616
Okanogan	40,151	816	1,461	32,849	34,812	--	110,089
Pend Oreille	12,727	1,362	--	24,450	--	--	38,539
Spokane	9,189	2,546	--	--	--	--	11,735
Stevens	1,197	2,715	588	2,194	7,374	--	14,068
Walla Walla	3,210	--	--	--	--	--	3,210
Whitman	--	--	--	--	--	--	--
Yakima	18,595	14,048	--	11,770	27,049	--	71,462
Total	212,931	73,171	3,333	132,615	118,126	--	540,176
Total Washington	3,851,613	403,691	10,838	818,071	226,165	--	5,310,378

1/ Includes volume removed as logs, poles, piling, cordwood, shingle bolts, etc., as compiled by the State Division of Forestry, except as noted.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands other than those for which timber sales were reported by the Commissioner of Public Lands.

3/ Based on Timber Sale Summary for BLM.

Table 13.–Log production by ownership and county in the State of Washington, 1951[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State	Bureau of Land Management[3/]	National Forest	Indian	Other Federal	Total
Western Washington:							
Clallam	145,100	8,554	505	84,611	38,624	--	277,394
Clark	52,703	--	--	--	--	--	52,703
Cowlitz	342,097	31,159	--	--	--	--	373,256
Grays Harbor	284,851	26,597	--	168,256	82,076	--	561,780
Island	24,058	529	--	--	--	--	24,587
Jefferson	172,689	375	690	25,347	--	--	199,101
King	224,505	--	--	32,106	1,207	--	257,818
Kitsap	108,959	115	--	--	--	--	109,074
Lewis	933,442	794	170	78,576	--	--	1,012,982
Mason	126,877	744	--	13,518	--	--	141,139
Pacific	465,133	75,343	--	--	--	--	540,476
Pierce	190,238	--	--	49,728	--	--	239,966
San Juan	22,887	--	--	--	--	--	22,887
Skagit	205,065	16,661	85	25,588	2,414	--	249,813
Skamania	129,306	6,552	403	127,339	--	--	263,600
Snohomish	137,552	8,369	--	93,784	1,207	--	240,912
Thurston	128,773	1,996	--	--	--	--	130,769
Wahkiakum	64,872	20,008	--	--	--	--	84,880
Whatcom	112,900	25,092	234	58,298	1,207	--	197,731
Total	3,872,007	222,888	2,087	757,151	126,735	--	4,980,868
Eastern Washington:							
Adams	--	--	--	--	--	--	--
Asotin	9,557	--	--	64	--	--	9,621
Benton	--	--	--	--	--	--	--
Chelan	22,297	--	--	24,503	--	--	46,800
Columbia	235	--	--	--	--	--	235
Douglas	--	--	--	--	--	--	--
Ferry	30,778	242	155	--	42,793	--	73,968
Franklin	--	--	--	--	--	--	--
Garfield	1,263	--	--	64	--	--	1,327
Grant	--	--	--	--	--	--	--
Kittitas	49,195	3,828	433	17,013	--	--	70,469
Klickitat	73,173	14,565	546	--	15,898	--	104,182
Lincoln	6,307	--	--	--	--	--	6,307
Okanogan	6,309	8,623	6,811	49,006	39,442	--	110,191
Pend Oreille	11,218	--	47	22,424	--	--	33,689
Spokane	15,922	--	--	--	--	--	15,922
Stevens	54,689	--	310	22,802	8,765	--	86,566
Walla Walla	176	--	--	--	--	--	176
Whitman	--	--	--	--	--	--	--
Yakima	28,071	10,740	--	20,651	27,468	--	86,930
Total	309,190	37,998	8,302	156,527	134,366	--	646,383
Total Washington	4,181,197	260,886	10,389	913,678	261,101	--	5,627,251

1/ Includes volume removed as logs, poles, piling, cordwood, shingle bolts, etc., as compiled by the State Division of Forestry, except as noted.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands other than those for which timber sales were reported by the Commissioner of Public Lands.

3/ Based on Timber Sale Summary for BLM.

Table 14.–Log production by ownership and county in the State of Washington, 1952[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State	Bureau of Land Management[3]	National Forest	Indian	Other Federal[4]	Total
Western Washington:							
Clallam	161,384	5,798	--	122,632	26,162	8,912	324,888
Clark	31,635	72	--	--	--	--	31,707
Cowlitz	338,772	6,246	--	--	--	--	345,018
Grays Harbor	270,776	1,199	--	132,408	106,942	--	511,325
Island	27,423	2,141	--	--	--	--	29,564
Jefferson	145,288	8,558	--	50,091	9,614	--	213,551
King	252,159	3,553	--	40,314	--	--	296,026
Kitsap	71,792	--	--	--	66	--	71,858
Lewis	628,885	28,278	--	50,815	--	--	707,978
Mason	69,464	--	--	50,211	49	--	119,724
Pacific	217,538	31,882	--	--	--	--	249,420
Pierce	243,620	86	--	37,900	--	--	281,606
San Juan	21,226	--	--	--	--	--	21,226
Skagit	134,139	31,323	--	24,502	66	--	190,030
Skamania	90,025	10,386	531	141,098	--	--	242,040
Snohomish	139,535	26,855	56	98,370	106	--	264,922
Thurston	149,625	--	--	--	231	--	149,856
Wahkiakum	92,458	253	--	--	--	--	92,711
Whatcom	133,191	25,440	--	22,450	--	--	181,081
Total	3,218,935	182,070	587	770,791	143,236	8,912	4,324,531
Eastern Washington:							
Adams	--	--	--	--	--	--	--
Asotin	6,742	--	--	--	--	--	6,742
Benton	--	--	--	--	--	--	--
Chelan	11,203	--	--	29,853	--	--	41,056
Columbia	1,093	--	--	749	--	--	1,842
Douglas	--	--	--	--	--	--	--
Ferry	13,300	--	118	30,875	51,748	--	96,041
Franklin	--	--	--	--	--	--	--
Garfield	5,579	--	--	107	--	--	5,686
Grant	--	--	--	--	--	--	--
Kittitas	59,616	2,168	--	17,548	--	--	79,332
Klickitat	134,016	1,384	--	2,354	--	--	137,754
Lincoln	5,672	--	--	--	--	--	5,672
Okanogan	25,136	2,171	--	37,450	34,557	--	99,314
Pend Oreille	10,735	2,151	--	20,102	--	--	32,988
Spokane	16,877	--	--	--	--	--	16,877
Stevens	61,620	2,619	1,755	3,377	6,672	--	76,043
Walla Walla	--	--	--	--	--	--	--
Whitman	--	--	--	--	--	--	--
Yakima	21,364	--	--	32,100	42,713	--	96,177
Total	372,953	10,493	1,873	174,515	135,690	--	695,524
Total Washington	3,591,888	192,563	2,460	945,306	278,926	8,912	5,020,055

1/ Includes volume removed as logs, poles, piling, cordwood, shingle bolts, etc., as compiled by the State Division of Forestry, except as noted.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands other than those for which timber sales were reported by the Commissioner of Public Lands.

3/ Based on Timber Sale Summary for BLM.

4/ Olympic National Park.

Table 15.–Log production by ownership and county in the State of Washington, 1953[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State	Bureau of Land Management[3]	National Forest	Indian	Other Federal[4]	Total
Western Washington:							
Clallam	111,936	11,509	380	242,366	22,950	17,664	406,805
Clark	11,768	4,838	--	--	--	--	16,606
Cowlitz	516,022	14,949	--	--	--	--	530,971
Grays Harbor	182,515	8,052	--	121,545	117,629	--	429,741
Island	23,907	437	--	--	--	--	24,344
Jefferson	15,635	43,283	--	48,521	5,389	--	112,828
King	183,370	23,307	--	34,158	--	--	240,835
Kitsap	33,493	--	--	--	43	--	33,536
Lewis	787,542	24,332	--	67,833	--	--	879,707
Mason	79,276	17,648	--	33,072	--	--	129,996
Pacific	428,014	67,249	--	--	--	--	495,263
Pierce	174,764	60	--	25,468	--	--	200,292
San Juan	18,092	--	--	--	--	--	18,092
Skagit	123,577	14,750	--	43,935	--	--	182,262
Skamania	13,960	31,895	1,031	140,374	--	--	187,260
Snohomish	97,627	42,546	--	83,645	117	--	223,935
Thurston	71,090	524	--	--	128	--	71,742
Wahkiakum	68,709	8,742	--	--	--	--	77,451
Whatcom	95,770	43,156	239	53,349	--	--	192,514
Total	3,037,067	357,277	1,650	894,266	146,256	17,664	4,454,180
Eastern Washington:							
Adams	--	--	--	--	--	--	--
Asotin	12,842	--	--	107	--	--	12,949
Benton	--	--	--	--	--	--	--
Chelan	12,035	--	--	40,767	--	--	52,802
Columbia	--	--	--	535	--	--	535
Douglas	--	--	--	--	--	--	--
Ferry	23,580	--	239	19,044	52,701	--	95,564
Franklin	--	--	--	--	--	--	--
Garfield	2,720	--	--	107	--	--	2,827
Grant	--	--	--	--	--	--	--
Kittitas	43,961	4,615	--	31,565	--	--	80,141
Klickitat	126,769	4,172	--	18,725	7,093	--	156,759
Lincoln	6,105	--	--	--	--	--	6,105
Okanogan	28,431	1,335	1,161	51,253	41,984	--	124,164
Pend Oreille	9,089	--	--	17,039	--	--	26,128
Spokane	17,713	--	--	--	--	--	17,713
Stevens	69,009	--	678	2,205	8,907	--	80,799
Walla Walla	--	--	--	--	--	--	--
Whitman	--	--	--	--	--	--	--
Yakima	6,761	27,121	--	34,347	55,319	--	123,548
Total	359,015	37,243	2,078	215,694	166,004	--	780,034
Total Washington	3,396,082	394,520	3,728	1,109,960	312,260	17,664	5,234,214

1/ Includes volume removed as logs, poles, piling, cordwood, shingle bolts, etc., as compiled by the State Division of Forestry, except as noted.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands other than those for which timber sales were reported by the Commissioner of Public Lands.

3/ Based on Timber Sale Summary for BLM.

4/ Olympic National Park.

Table 16.–Log production by ownership and county in the State of Washington, 1954[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State	Bureau of Land Management[3]	National Forest	Indian	Other Federal[4]	Total
stern Washington:							
Clallam	135,806	3,753	1,681	236,813	13,758	5,844	397,655
Clark	51,456	--	--	--	--	--	51,456
Cowlitz	418,059	1,253	--	--	--	--	419,312
Grays Harbor	153,964	42,784	--	119,131	118,944	--	434,823
Island	20,435	--	--	--	--	--	20,435
Jefferson	9,669	64,407	--	48,280	6,133	1,962	130,451
King	218,747	15,200	--	5,552	--	--	239,499
Kitsap	29,184	40	--	--	607	--	29,831
Lewis	573,637	56,766	330	62,643	--	--	693,376
Mason	91,623	16,840	--	13,277	--	--	121,740
Pacific	218,783	34,566	--	--	--	--	253,349
Pierce	172,258	523	--	36,451	--	157	209,389
San Juan	16,589	--	--	--	--	--	16,589
Skagit	14,820	92,739	34	21,243	810	--	129,646
Skamania	87,315	17,629	988	172,963	--	--	278,895
Snohomish	57,742	43,800	--	96,922	404	--	198,868
Thurston	117,122	127	--	--	252	--	117,501
Wahkiakum	65,787	2,098	--	--	--	--	67,885
Whatcom	98,629	24,296	530	66,264	298	--	190,017
Total	2,551,625	416,821	3,563	879,539	141,206	7,963	4,000,717
Etern Washington:							
Adams	--	--	--	--	--	--	--
Asotin	4,462	3,400	--	107	--	--	7,969
Benton	--	--	--	--	--	--	--
Chelan	10,843	--	--	36,059	--	--	46,902
Columbia	7,958	--	--	--	--	--	7,958
Douglas	--	--	--	--	--	--	--
Ferry	25,406	495	183	35,068	46,441	--	107,593
Franklin	--	--	--	--	--	--	--
Garfield	463	--	--	107	--	--	570
Grant	--	--	--	--	--	--	--
Kittitas	60,855	1,768	574	23,005	--	--	86,202
Klickitat	120,980	3,614	--	15,729	5,287	--	145,610
Lincoln	2,300	865	--	--	--	--	3,165
Okanogan	34,443	882	4,346	66,661	25,636	--	131,968
Pend Oreille	12,619	--	--	14,665	157	--	27,441
Spokane	20,373	--	--	--	--	--	20,373
Stevens	80,921	678	1,708	6,026	6,070	--	95,403
Walla Walla	3,210	--	--	--	--	--	3,210
Whitman	659	--	--	--	--	--	659
Yakima	16,398	--	--	23,540	59,229	--	99,167
Total	401,890	11,702	6,811	220,967	142,820	--	784,190
Total Washington	2,953,515	428,523	10,374	1,100,506	284,026	7,963	4,784,907

1/ Includes volume removed as logs, poles, piling, cordwood, shingle bolts, etc., as compiled by the State Division of Forestry, except as noted.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands other than those for which timber sales were reported by the Commissioner of Public Lands.

3/ Based on Timber Sale Summary for BLM.

4/ National Parks.

Table 17.–Log production by ownership and county in the State of Washington, 1955[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State	Bureau of Land Management	National Forest	Indian	Other Federal[3/]	Total
Western Washington:							
Clallam	155,007	26,540	420	156,279	39,563	9,024	386,833
Clark	46,447	2,366	--	--	--	--	48,813
Cowlitz	484,123	46,585	--	--	--	--	530,708
Grays Harbor	173,308	49,917	--	88,409	173,109	266	485,009
Island	27,291	--	--	--	--	--	27,291
Jefferson	113,318	83,398	--	56,726	625	6,757	260,824
King	276,641	19,097	76	10,386	--	--	306,200
Kitsap	33,320	--	--	--	--	--	33,320
Lewis	547,405	39,575	392	85,908	--	--	673,280
Mason	116,940	3,880	--	552	--	--	121,372
Pacific	330,247	64,542	--	--	--	--	394,789
Pierce	215,837	35,040	--	24,937	--	1,225	277,039
San Juan	19,728	--	--	--	--	--	19,728
Skagit	99,265	49,136	--	62,689	875	--	211,965
Skamania	104,039	19,372	--	200,594	--	--	324,005
Snohomish	97,753	26,984	--	85,716	579	--	211,032
Thurston	136,739	5,646	--	--	--	--	142,385
Wahkiakum	75,527	1,472	--	--	--	--	76,999
Whatcom	80,708	20,527	271	60,238	4,547	--	166,291
Total	3,133,643	494,077	1,159	832,434	219,298	17,272	4,697,883
Eastern Washington:							
Adams	--	--	--	--	--	--	--
Asotin	4,150	--	--	29	--	--	4,179
Benton	--	--	--	--	--	--	--
Chelan	29,677	--	--	25,861	--	--	55,538
Columbia	6,891	--	--	--	--	--	6,891
Douglas	--	--	--	--	--	--	--
Ferry	31,110	3,248	966	26,106	54,928	--	116,358
Franklin	--	--	--	--	--	--	--
Garfield	3,091	--	--	59	--	--	3,150
Grant	--	--	--	--	--	--	--
Kittitas	67,286	8,943	26	29,510	--	--	105,765
Klickitat	104,226	7,871	--	7,800	10,200	--	130,097
Lincoln	929	--	62	--	--	--	991
Okanogan	32,668	1,059	6,680	53,117	34,842	--	128,366
Pend Oreille	19,172	--	--	23,005	347	--	42,524
Spokane	19,954	109	--	--	--	--	20,063
Stevens	91,010	2,777	1,403	4,190	6,030	--	105,410
Walla Walla	984	--	--	--	--	--	984
Whitman	--	--	--	--	--	--	--
Yakima	14,486	17,866	--	15,174	43,629	--	91,155
Total	425,634	41,873	9,137	184,851	149,976	--	811,471
Total Washington	3,559,277	535,950	10,296	1,017,285	369,274	17,272	5,509,354

1/ Includes volume removed as logs, poles, piling, cordwood, shingle bolts, etc., as compiled by the State Division of Forestry, except as noted.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands other than those for which timber sales were reported by the Commissioner of Public Lands.

3/ National Parks.

Table 18.–Log production by ownership and county in the State of Washington, 1956[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State	Bureau of Land Management	National Forest	Indian	Other Federal[3]	Total
tern Washington:							
Clallam	178,224	34,095	--	75,075	154	3,795	291,343
Clark	40,210	428	--	--	--	--	40,638
Cowlitz	455,067	78,934	--	--	--	--	534,001
Grays Harbor	230,326	52,603	--	114,303	136,835	--	534,067
Island	16,030	250	--	--	--	--	16,280
Jefferson	122,148	56,898	--	50,332	--	2,495	231,873
King	298,112	51,955	111	21,364	--	--	371,542
Kitsap	61,977	640	--	--	2,792	--	65,409
Lewis	566,088	52,113	--	68,678	--	314	687,193
Mason	101,885	911	--	82,921	--	--	185,717
Pacific	414,375	58,955	1,699	--	--	--	475,029
Pierce	231,982	52,645	--	31,382	--	--	316,009
San Juan	32,812	--	--	--	--	--	32,812
Skagit	77,643	28,072	--	44,297	2,636	--	152,648
Skamania	120,450	15,109	--	236,572	--	--	372,131
Snohomish	128,157	40,182	--	80,145	1,176	--	249,660
Thurston	162,581	20,111	--	--	--	--	182,692
Wahkiakum	176,454	32,728	--	--	--	--	209,182
Whatcom	108,684	20,786	--	72,661	317	--	202,448
Total	3,523,205	597,415	1,810	877,730	143,910	6,604	5,150,674
ern Washington:							
Adams	--	--	--	--	--	--	--
Asotin	3,386	--	--	--	--	--	3,386
Benton	--	--	--	--	--	--	--
Chelan	21,210	1,148	--	46,545	--	--	68,903
Columbia	7,558	--	--	--	--	--	7,558
Douglas	--	--	--	--	--	--	--
Ferry	29,158	--	779	18,423	54,037	--	102,397
Franklin	--	--	--	--	--	--	--
Garfield	668	--	--	--	--	--	668
Grant	--	--	--	--	--	--	--
Kittitas	25,581	9,478	4,868	23,540	--	--	63,467
Klickitat	103,854	9,157	--	1,498	10,087	--	124,596
Lincoln	4,026	--	--	--	--	--	4,026
Okanogan	24,483	3,476	4,960	60,883	32,273	--	126,075
Pend Oreille	18,912	--	--	44,788	20	--	63,720
Spokane	22,346	--	--	--	--	--	22,346
Stevens	92,498	544	4,172	6,756	19,709	--	123,679
Walla Walla	2,151	--	--	--	--	--	2,151
Whitman	--	--	--	--	--	--	--
Yakima	10,306	10,741	--	30,067	57,096	--	108,210
Total	366,137	34,544	14,779	232,500	173,222	--	821,182
ot Washington	3,889,342	631,959	16,589	1,110,230	317,132	6,604	5,971,856

1/ Includes volume removed as logs, poles, piling, cordwood, shingle bolts, etc., as compiled by the State Division of ry, except as noted.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands other than those for which im sales were reported by the Commissioner of Public Lands.

3/ National Parks.

Table 19.–Log production by ownership and county in the State of Washington, 1957[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State	Bureau of Land Management	National Forest	Indian	Other Federal[3]	Total
Western Washington:							
Clallam	180,297	16,426	12	44,296	--	5,016	246,047
Clark	20,316	12	--	--	--	--	20,328
Cowlitz	379,522	106,245	--	--	--	--	485,767
Grays Harbor	178,676	12,304	--	105,890	72,683	671	370,224
Island	25,602	--	--	--	--	--	25,602
Jefferson	104,636	45,276	--	67,182	164	1,635	218,893
King	238,102	10,583	--	35,792	--	--	284,477
Kitsap	41,404	1,755	--	--	24	--	43,183
Lewis	474,800	25,964	2,516	38,891	1,512	--	543,683
Mason	97,770	1,822	--	84,340	--	--	183,932
Pacific	238,474	33,903	3,410	--	--	--	275,787
Pierce	199,160	386	--	30,237	--	381	230,164
San Juan	8,591	--	--	--	--	--	8,591
Skagit	55,678	36,841	--	54,883	1,086	--	148,488
Skamania	97,039	88,619	1,755	183,947	--	--	371,360
Snohomish	82,182	35,526	--	50,040	2,422	--	170,170
Thurston	95,175	11,008	--	--	--	--	106,183
Wahkiakum	59,375	8,792	--	--	--	--	68,167
Whatcom	46,052	15,208	--	115,837	82	--	177,179
Total	2,622,851	450,670	7,693	811,335	77,973	7,703	3,978,225
Eastern Washington:							
Adams	--	--	--	--	--	--	--
Asotin	2,976	--	--	--	--	--	2,976
Benton	--	--	--	--	--	--	--
Chelan	20,047	1,974	71	46,422	--	--	68,514
Columbia	9,107	--	--	1,933	--	--	11,040
Douglas	--	--	--	--	--	--	--
Ferry	28,027	1,517	1,318	36,721	44,288	--	111,871
Franklin	--	--	--	--	--	--	--
Garfield	1,891	--	--	545	--	--	2,436
Grant	--	--	--	--	--	--	--
Kittitas	40,957	8,513	2,371	30,829	--	--	82,670
Klickitat	119,558	6,704	--	4,066	11,034	--	141,362
Lincoln	5,911	--	--	--	--	--	5,911
Okanogan	19,415	9,196	1,915	60,920	20,806	--	112,252
Pend Oreille	18,455	--	--	19,834	1,081	--	39,370
Spokane	16,980	54	--	--	--	--	17,034
Stevens	70,281	1,108	1,048	14,326	10,254	--	97,017
Walla Walla	10,363	--	--	--	--	--	10,363
Whitman	284	--	--	--	--	--	284
Yakima	18,458	4,505	--	28,250	51,703	--	102,916
Total	382,710	33,571	6,723	243,846	139,166	--	806,016
Total Washington	3,005,561	484,241	14,416	1,055,181	217,139	7,703	4,784,241

1/ Includes volume in logs, poles, pilings, cordwood, shingle bolts, etc., as compiled by Washington State Department of Natural Resources.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands not administered by Washington State Department of Natural Resources.

3/ National Parks.

Table 20.–Log production by ownership and county in the State of Washington, 1958[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State	Bureau of Land Management	National Forest	Indian	Other Federal[3]	Total
estern Washington:							
Clallam	136,958	6,343	--	56,775	48	58	200,182
Clark	15,191	1,534	--	--	--	--	16,725
Cowlitz	369,942	88,751	--	3,742	--	--	462,435
Grays Harbor	193,154	50,364	--	96,961	78,303	4	418,786
Island	18,416	--	--	--	--	--	18,416
Jefferson	76,848	38,762	--	66,138	14,027	2,034	197,809
King	246,562	898	--	25,739	--	--	273,199
Kitsap	30,262	124	--	--	--	--	30,386
Lewis	442,217	49,658	--	101,930	--	--	593,805
Mason	66,379	328	--	104,723	--	--	171,430
Pacific	214,210	42,118	5,165	--	--	--	261,493
Pierce	177,027	2,247	--	28,684	--	1,007	208,965
San Juan	6,348	--	--	--	--	--	6,348
Skagit	67,015	4,344	--	69,395	314	--	141,068
Skamania	79,475	23,469	--	225,911	--	--	328,855
Snohomish	61,446	8,404	--	78,663	844	--	149,357
Thurston	71,094	3,543	--	--	--	--	74,637
Wahkiakum	58,863	19,485	--	--	--	--	78,348
Whatcom	34,968	5,008	--	78,069	--	--	118,045
Total	2,366,375	345,380	5,165	936,730	93,536	3,103	3,750,289
stern Washington:							
Adams	--	--	--	--	--	--	--
Asotin	6,304	--	--	2	--	--	6,306
Benton	--	--	--	--	--	--	--
Chelan	9,981	--	1,470	51,476	--	--	62,927
Columbia	16,721	--	--	9,689	--	--	26,410
Douglas	16	--	--	--	--	--	16
Ferry	25,180	--	1,084	31,239	66,193	--	123,696
Franklin	--	--	--	--	--	--	--
Garfield	907	--	--	41	--	--	948
Grant	--	--	--	--	--	--	--
Kittitas	50,415	991	1,087	42,283	--	--	94,776
Klickitat	95,127	6,585	--	4,510	10,905	--	117,127
Lincoln	4,173	--	--	--	--	--	4,173
Okanogan	16,494	11,030	4,419	65,302	13,319	--	110,564
Pend Oreille	19,574	--	--	35,475	1,064	--	56,113
Spokane	12,981	--	--	--	--	--	12,981
Stevens	74,169	962	2,703	12,000	6,772	--	96,606
Walla Walla	9,109	--	--	--	--	--	9,109
Whitman	--	--	--	--	--	--	--
Yakima	13,167	840	--	16,330	73,928	--	104,265
Total	354,318	20,408	10,763	268,347	172,181	--	826,017
al Washington	2,720,693	365,788	15,928	1,205,077	265,717	3,103	4,576,306

1/ Includes volume in logs, poles, pilings, cordwood, shingle bolts, etc., as compiled by Washington State Department o Natural Resources.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands not administered by W ington State Department of Natural Resources.

3/ National Parks.

Table 21.–Log production by ownership and county in the State of Washington, 1959[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State	Bureau of Land Management	National Forest	Indian	Other Federal[3]	Total
Western Washington:							
Clallam	213,679	39,802	--	79,725	--	--	333,20
Clark	19,282	3,533	--	--	--	--	22,81
Cowlitz	324,500	95,143	287	7,417	--	--	427,34
Grays Harbor	269,831	15,174	--	122,005	134,234	--	541,24
Island	22,084	--	--	--	--	--	22,08
Jefferson	147,792	38,805	56	82,384	--	--	269,03
King	201,323	1,486	--	30,287	--	--	233,09
Kitsap	43,024	--	--	--	--	--	43,02
Lewis	528,729	10,828	112	189,406	--	--	729,07
Mason	91,370	1,618	--	104,900	--	--	197,88
Pacific	298,398	3,316	3,784	--	--	--	305,49
Pierce	321,993	33,261	--	29,913	--	244	385,41
San Juan	10,994	--	--	--	--	--	10,99
Skagit	69,638	14,058	--	119,579	599	--	203,87
Skamania	68,468	2,166	2,507	343,407	--	--	416,54
Snohomish	97,215	40,465	--	123,074	844	--	261,59
Thurston	76,453	3,290	--	--	--	--	79,74
Wahkiakum	107,397	5,063	--	--	--	--	112,46
Whatcom	72,470	14,717	--	104,366	81	--	191,63
Total	2,984,640	322,725	6,746	1,336,463	135,758	244	4,786,57
Eastern Washington:							
Adams	--	--	--	--	--	--	-
Asotin	6,909	--	--	28	--	--	6,9
Benton	--	--	--	--	--	--	-
Chelan	13,126	542	746	66,298	--	--	80,71
Columbia	19,719	--	--	1,725	--	--	21,44
Douglas	41	--	--	--	--	--	4
Ferry	15,344	--	1,839	37,144	98,588	--	152,9
Franklin	--	--	--	--	--	--	-
Garfield	1,198	--	--	6,616	--	--	7,8
Grant	--	--	--	--	--	--	-
Kittitas	52,315	1,611	853	77,280	--	--	132,0
Klickitat	68,467	5,353	382	1,891	9,495	--	85,5
Lincoln	3,262	--	110	--	--	--	3,3
Okanogan	37,473	9,342	6,198	78,462	13,912	--	145,3
Pend Oreille	25,535	--	--	43,795	587	--	69,9
Spokane	19,590	--	--	--	--	--	19,5
Stevens	85,854	2,451	4,796	11,089	6,893	--	111,0
Walla Walla	10,102	--	--	--	--	--	10,1
Whitman	--	--	--	--	--	--	
Yakima	10,007	3,991	--	29,112	75,646	--	118,7
Total	368,942	23,290	14,924	353,440	205,121	--	965,7
Total Washington	3,353,582	346,015	21,670	1,689,903	340,879	244	5,752,2

[1] Includes volume in logs, poles, pilings, cordwood, shingle bolts, etc., as compiled by Washington State Department of Natural Resources.

[2] Includes data on lands owned by cities, counties, public utility districts, and State lands not administered by Washington State Department of Natural Resources.

[3] National Parks.

Table 22.–Log production by ownership and county in the State of Washington, 1960[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State	Bureau of Land Management	National Forest	Indian	Other Federal	Total
stern Washington:							
Clallam	237,920	34,230	--	56,086	13,852	232	342,320
Clark	12,751	542	--	--	--	--	13,293
Cowlitz	463,751	76,040	--	42,136	--	--	581,927
Grays Harbor	330,088	13,052	--	70,080	116,460	--	529,680
Island	23,512	2,628	--	--	--	--	26,140
Jefferson	114,289	62,138	--	73,976	8,525	1,655	260,583
King	330,483	4,970	--	33,915	--	1,249	370,617
Kitsap	32,954	896	--	--	--	--	33,850
Lewis	387,329	28,034	66	167,655	--	--	583,084
Mason	93,228	1,167	--	102,730	151	88	197,364
Pacific	272,729	9,404	--	--	--	3,709	285,842
Pierce	280,935	2,775	--	28,745	--	147	312,602
San Juan	9,498	--	--	--	--	--	9,498
Skagit	101,706	15,462	--	97,072	1,095	--	215,335
Skamania	55,341	7,428	58	254,324	--	--	317,151
Snohomish	130,024	31,672	--	106,401	320	--	268,417
Thurston	54,397	2,488	--	--	--	--	56,885
Wahkiakum	151,254	187	--	--	--	--	151,441
Whatcom	60,209	14,243	--	63,130	--	--	137,582
Total	3,142,398	307,356	124	1,096,250	140,403	7,080	4,693,611
tern Washington:							
dams	--	--	--	--	--	--	--
sotin	5,723	--	--	1,432	--	--	7,155
enton	--	--	--	--	--	--	--
helan	13,945	--	--	60,600	--	--	74,545
olumbia	13,074	--	--	326	--	--	13,400
ouglas	--	--	--	--	--	--	--
erry	23,632	144	728	34,640	64,573	--	123,717
ranklin	--	--	--	--	--	--	--
arfield	2,140	--	--	6,204	--	--	8,344
rant	--	--	--	--	--	--	--
ittitas	81,856	3,874	3,274	60,560	--	--	149,564
lickitat	87,781	2,305	227	175	6,109	--	96,597
incoln	3,344	--	--	--	--	--	3,344
kanogan	52,770	5,430	5,592	72,228	2,245	--	138,265
end Oreille	15,547	--	958	25,468	--	--	41,973
pokane	20,194	324	--	--	--	--	20,518
tevens	81,260	3,055	1,897	13,276	6,631	--	106,119
alla Walla	4,772	--	--	--	--	--	4,772
hitman	182	--	--	--	--	--	182
akima	18,191	3,430	--	16,914	69,746	--	108,281
Total	424,411	18,562	12,676	291,823	149,304	--	896,776
o l Washington	3,566,809	325,918	12,800	1,388,073	289,707	7,080	5,590,387

1/ Includes volume in logs, poles, pilings, cordwood, shingle bolts, etc., as compiled by Washington State Department of atural Resources.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands not administered by Wa ington State Department of Natural Resources.

Table 23.–Log production by ownership and county in the State of Washington, 1961[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State	Bureau of Land Management	National Forest	Indian	Other Federal	Total
Western Washington:							
Clallam	211,839	34,209	--	64,807	317	331	311,50
Clark	41,415	450	--	--	--	--	41,86
Cowlitz	375,486	86,023	--	31,657	--	--	493,16
Grays Harbor	234,221	4,643	--	95,149	140,858	--	474,87
Island	20,784	34	--	--	--	--	20,81
Jefferson	140,267	75,561	--	58,910	4,444	179	279,36
King	223,746	12,458	--	21,360	--	--	257,56
Kitsap	33,977	536	--	--	215	--	34,72
Lewis	310,311	21,319	--	150,734	--	706	483,07
Mason	100,247	4,334	--	46,542	--	696	151,81
Pacific	368,906	24,129	--	--	--	1,919	394,95
Pierce	270,721	18,023	--	40,296	--	706	329,74
San Juan	6,756	--	--	--	--	--	6,75
Skagit	80,271	13,467	--	65,342	1,025	--	160,10
Skamania	96,858	21,538	--	293,010	--	--	411,40
Snohomish	95,428	15,779	110	136,311	330	90	248,04
Thurston	46,895	2,039	--	--	--	--	48,93
Wahkiakum	112,588	2,863	--	--	--	--	115,45
Whatcom	47,612	7,051	--	72,100	352	--	127,11
Total	2,818,328	344,456	110	1,076,218	147,541	4,627	4,391,28
Eastern Washington:							
Adams	--	--	--	--	--	--	
Asotin	2,500	--	--	--	--	--	2,50
Benton	--	--	--	--	--	--	
Chelan	8,981	975	380	64,941	--	--	75,27
Columbia	19,703	103	--	1,840	--	--	21,64
Douglas	1,340	--	--	--	--	--	1,34
Ferry	11,039	21	1,841	25,922	72,349	--	111,11
Franklin	--	--	--	--	--	--	
Garfield	4,555	--	--	1,743	--	--	6,29
Grant	--	--	--	--	--	--	
Kittitas	94,146	2,676	--	41,236	--	--	138,05
Klickitat	55,110	4,020	--	461	8,145	--	67,73
Lincoln	2,997	599	--	--	--	--	3,59
Okanogan	22,212	7,086	5,496	60,675	8,331	--	103,80
Pend Oreille	12,497	--	--	54,352	--	--	66,84
Spokane	16,144	174	--	--	--	--	16,31
Stevens	50,619	1,212	2,912	23,839	7,266	--	85,84
Walla Walla	5,970	--	--	--	--	--	5,97
Whitman	--	--	--	--	--	--	
Yakima	31,643	1,640	--	33,641	80,036	--	146,91
Total	339,456	18,506	10,629	308,650	176,127	--	853,36
Total Washington	3,157,784	362,962	10,739	1,384,868	323,668	4,627	5,244,64

1/ Includes volume in logs, poles, pilings, cordwood, shingle bolts, etc., as compiled by Washington State Department of Natural Resources.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands not administered by Washington State Department of Natural Resources.

Table 24.–Log production by ownership and county in the State of Washington, 1962[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State	Bureau of Land Management	National Forest	Indian	Other Federal	Total
tern Washington:							
Clallam	157,185	31,428	--	85,697	1,934	1,703	277,947
Clark	87,750	2,827	--	--	--	--	90,577
Cowlitz	443,027	47,774	--	6,880	--	--	497,681
Grays Harbor	266,450	4,249	--	86,904	141,267	--	498,870
Island	15,132	--	--	--	--	--	15,132
Jefferson	115,003	91,272	--	85,697	1,991	1,325	295,288
King	253,206	21,853	--	24,502	--	217	299,778
Kitsap	24,184	101	--	--	--	1,207	25,492
Lewis	464,568	21,308	--	172,118	--	38	658,032
Mason	88,108	9,049	--	71,575	17	--	168,749
Pacific	438,653	24,961	--	--	--	--	463,614
Pierce	315,748	15,785	--	48,521	--	635	380,689
San Juan	6,748	--	--	--	--	--	6,748
Skagit	74,966	23,227	--	75,558	664	--	174,415
Skamania	111,688	6,343	--	401,086	--	--	519,117
Snohomish	126,217	7,785	--	182,619	643	--	317,264
Thurston	58,164	2,401	--	--	--	--	60,565
Wahkiakum	106,048	17,451	--	--	--	--	123,499
Whatcom	39,522	25,276	--	81,835	664	--	147,297
Total	3,192,367	353,090	--	1,322,992	147,180	5,125	5,020,754
ern Washington:							
dams	--	--	--	--	--	--	--
sotin	25,517	--	--	1,070	--	--	26,587
enton	--	--	--	--	--	--	--
helan	6,952	217	1,244	76,184	--	--	84,597
olumbia	7,966	--	334	5,671	--	--	13,971
ouglas	498	--	--	--	--	--	498
erry	12,625	4,122	1,722	47,228	84,378	--	150,075
ranklin	--	--	--	--	--	--	--
arfield	1,231	--	--	7,383	--	--	8,614
rant	--	--	--	--	--	--	--
ittitas	53,442	1,536	--	71,262	--	--	126,240
lickitat	51,078	1,141	--	--	9,798	--	62,017
incoln	1,338	--	--	--	--	--	1,338
kanogan	12,075	6,456	306	88,917	21,774	--	129,528
end Oreille	17,264	349	--	53,681	--	--	71,294
pokane	15,398	--	--	--	--	--	15,398
tevens	48,968	3,900	1,446	19,212	7,372	--	80,898
alla Walla	6,378	--	--	--	--	--	6,378
hitman	70	--	--	--	--	--	70
akima	31,589	16,280	708	57,459	70,524	--	176,560
Total	292,389	34,001	5,760	428,067	193,846	--	954,063
To l Washington	3,484,756	387,091	5,760	1,751,059	341,026	5,125	5,974,817

1/ Includes volume in logs, poles, pilings, cordwood, shingle bolts, etc., as compiled by Washington State Department of ıtural Resources.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands not administered by Was ngton State Department of Natural Resources.

Table 25.–Log production by ownership and county in the State of Washington, 1963[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private	State	Bureau of Land Management	National Forest	Indian	Other public[2/]	Other Federal	Total
Western Washington:								
Clallam	212,629	54,540	--	127,459	5,178	712	1,299	401,817
Clark	36,897	2,305	--	--	--	415	--	39,617
Cowlitz	521,423	167,582	--	9,535	--	1,025	--	699,565
Grays Harbor	295,297	3,102	--	131,322	145,086	3,859	7	578,673
Island	19,743	356	--	--	--	146	--	20,245
Jefferson	120,751	111,280	--	99,578	--	--	445	332,054
King	190,264	40,459	--	58,540	--	3,901	--	293,164
Kitsap	18,434	2,390	--	--	309	1,784	--	22,917
Lewis	451,959	24,590	--	191,792	--	276	--	668,617
Mason	78,093	2,173	--	77,852	--	395	--	158,513
Pacific	494,014	12,757	--	--	--	6,795	96	513,662
Pierce	298,550	39,160	--	51,418	--	733	147	390,008
San Juan	4,625	--	--	--	--	--	--	4,625
Skagit	78,935	20,915	--	65,178	572	472	--	166,072
Skamania	40,146	4,629	--	358,962	--	--	--	403,737
Snohomish	151,161	70,469	--	163,548	636	58	--	385,872
Thurston	84,332	6,446	--	--	--	5,168	--	95,946
Wahkiakum	55,097	5,130	--	--	--	18	--	60,245
Whatcom	52,709	43,408	--	78,697	1,087	31	--	175,932
Total	3,205,059	611,691	--	1,413,881	152,868	25,788	1,994	5,411,281
Eastern Washington:								
Adams	--	--	--	--	--	--	--	--
Asotin	867	--	--	2,675	--	--	--	3,542
Benton	--	--	--	--	--	--	--	--
Chelan	11,909	2,725	--	81,855	--	15	--	96,504
Columbia	8,187	--	--	3,531	--	--	--	11,718
Douglas	--	--	--	--	--	--	--	--
Ferry	12,738	1,170	26	50,672	94,114	--	--	158,720
Franklin	--	--	--	--	--	--	--	--
Garfield	601	--	--	15,194	--	--	--	15,795
Grant	--	--	--	--	--	--	--	--
Kittitas	77,995	3,377	--	37,022	--	--	--	118,394
Klickitat	52,264	5,592	--	--	10,422	547	--	68,825
Lincoln	707	894	--	--	--	--	--	1,601
Okanogan	6,367	9,237	60	90,950	24,355	--	--	130,969
Pend Oreille	21,968	579	--	66,243	293	1,214	--	90,297
Spokane	11,168	356	--	--	--	--	--	11,524
Stevens	48,380	6,430	67	29,381	10,046	--	--	94,304
Walla Walla	15,124	--	--	--	--	--	--	15,124
Whitman	123	--	--	--	--	--	--	123
Yakima	30,363	11,622	--	63,237	87,408	408	--	193,038
Total	298,761	41,982	153	440,760	226,638	2,184	--	1,010,478
Total Washington	3,503,820	653,673	153	1,854,641	379,506	27,972	1,994	6,421,759

1/ Includes volume in logs, poles, pilings, cordwood, shingle bolts, etc., as compiled by Washington State Department of Natural Resources.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands not administered by Washington State Department of Natural Resources.

Table 26.–Log production by ownership and county in the State of Washington, 1964[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private	State	Bureau of Land Management	National Forest[2]	Indian	Other public[3]	Other Federal	Total
Western Washington:								
Clallam	204,963	32,801	--	114,786	10,535	9,581	5,008	377,674
Clark	17,324	931	--	--	--	--	--	18,255
Cowlitz	619,142	205,562	--	30,658	--	--	--	855,362
Grays Harbor	375,757	12,597	--	125,166	189,732	20,291	991	724,534
Island	15,092	--	--	--	--	669	--	15,761
Jefferson	141,480	112,202	--	118,165	10,226	196	463	382,732
King	349,214	43,361	--	72,541	--	11,161	--	476,277
Kitsap	20,495	3,917	--	--	--	868	1,026	26,306
Lewis	642,913	49,902	--	185,637	--	--	42	878,494
Mason	79,137	6,307	--	129,270	--	99	436	215,249
Pacific	516,696	13,450	--	--	--	1,151	3,698	534,995
Pierce	322,443	14,873	--	83,404	--	713	24	421,457
San Juan	5,125	--	--	--	--	--	--	5,125
Skagit	102,683	17,223	--	117,924	--	25	--	237,855
Skamania	65,743	9,360	--	348,099	--	36	--	423,238
Snohomish	100,269	45,359	--	117,200	--	263	--	263,091
Thurston	154,208	8,280	--	--	--	973	--	163,461
Wahkiakum	56,019	6,607	--	--	--	39	--	62,665
Whatcom	80,292	23,844	--	95,112	--	103	--	199,351
Total	3,868,995	606,576	--	1,537,962	210,493	46,168	11,688	6,281,882
Eastern Washington:								
Adams	--	--	--	--	--	--	--	--
Asotin	2,693	--	--	4,280	--	--	--	6,973
Benton	--	--	--	--	--	--	--	--
Chelan	19,649	472	--	76,505	--	--	--	96,626
Columbia	4,749	--	--	3,103	--	--	--	7,852
Douglas	--	--	--	--	--	--	--	--
Ferry	13,250	2,404	--	51,142	89,565	4	--	156,365
Franklin	--	--	--	--	--	--	--	--
Garfield	5,824	693	--	16,157	--	--	--	22,674
Grant	--	--	--	--	--	--	--	--
Kittitas	87,599	4,688	--	74,472	--	--	--	166,759
Klickitat	43,979	1,220	--	2,782	10,220	--	--	58,201
Lincoln	--	164	--	--	--	--	--	164
Okanogan	24,009	7,965	601	93,304	34,688	--	--	160,567
Pend Oreille	23,405	446	--	65,176	455	--	--	89,482
Spokane	10,945	458	--	--	--	129	--	11,532
Stevens	58,997	4,542	218	32,055	9,830	--	3,725	109,367
Walla Walla	7,769	--	--	--	--	--	--	7,769
Whitman	--	--	--	--	--	--	--	--
Yakima	16,095	13,178	--	63,130	122,513	--	--	214,916
Total	318,963	36,230	819	482,106	267,271	133	3,725	1,109,247
Total Washington	4,187,958	642,806	819	2,020,068	477,764	46,301	15,413	7,391,129

1/ Includes volume in logs, poles, pilings, cordwood, shingle bolts, etc., as compiled by Washington State Department of Natural Resources.

2/ Data on Region 6 National Forests were compiled by Pacific Northwest Forest and Range Experiment Station.

3/ Includes data on lands owned by cities, counties, public utility districts, and State lands not administered by Washington State Department of Natural Resources.

Table 27.–Log production by ownership and county in the State of Washington, 1965[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private	State	Bureau of Land Management	National Forest[2/3]	Indian[3]	Other public[3]	Other Federal	Total
Western Washington:								
Clallam	186,036	103,104	--	84,249	10,151	3,500	5,211	392,251
Clark	32,588	12,396	--	--	--	63	--	45,047
Cowlitz	599,145	212,794	--	55,281	--	30	--	867,250
Grays Harbor	370,751	6,902	--	169,584	205,254	10,000	181	762,672
Island	11,917	--	--	--	--	--	109	12,026
Jefferson	147,532	177,118	--	59,505	7,170	--	1,106	392,431
King	297,709	15,269	--	62,281	--	27,969	4,695	407,923
Kitsap	19,850	2,513	--	--	72	1,079	422	23,936
Lewis	749,829	44,112	8	202,052	--	725	12	996,738
Mason	76,660	8,588	--	133,011	--	1,308	1,147	220,714
Pacific	580,556	18,512	--	--	--	109	5,614	604,791
Pierce	244,136	28,287	--	51,539	--	822	4,231	329,015
San Juan	5,438	--	--	--	--	211	--	5,649
Skagit	121,603	17,398	68	108,027	1,826	81	--	249,003
Skamania	79,488	5,719	--	374,774	37	--	--	460,018
Snohomish	238,259	34,063	--	141,219	--	1,593	72	415,206
Thurston	82,940	6,532	--	--	--	--	320	89,792
Wahkiakum	108,559	18,937	--	--	--	133	54	127,683
Whatcom	71,255	31,165	--	111,889	--	532	--	214,841
Total	4,024,251	743,409	76	1,553,411	224,510	48,155	23,174	6,616,986
Eastern Washington:								
Adams	--	--	--	--	--	--	--	--
Asotin	381	--	--	5,564	--	--	--	5,945
Benton	--	--	--	--	--	--	--	--
Chelan	19,868	--	--	82,925	--	10	--	102,803
Columbia	8,426	--	--	1,926	--	--	--	10,352
Douglas	--	--	--	--	--	--	--	--
Ferry	11,984	1,833	--	57,490	103,396	--	2,358	177,061
Franklin	--	--	--	--	--	--	--	--
Garfield	148	--	--	11,770	--	--	--	11,918
Grant	--	--	--	--	--	--	--	--
Kittitas	52,651	14,786	--	86,670	--	745	1,288	156,140
Klickitat	49,726	9,305	--	2,354	23,283	--	139	84,807
Lincoln	220	--	--	--	--	--	--	220
Okanogan	2,160	20,334	124	106,358	31,015	64	--	160,055
Pend Oreille	21,214	2,233	110	38,183	1,348	--	--	63,088
Spokane	12,676	904	--	--	--	--	--	13,580
Stevens	46,268	12,562	454	23,193	11,408	--	1,826	95,711
Walla Walla	4,681	2,682	--	--	--	--	--	7,363
Whitman	--	--	--	--	--	--	--	--
Yakima	44,403	9,498	--	46,973	122,443	--	--	223,317
Total	274,806	74,137	688	463,406	292,893	819	5,611	1,112,360
Total Washington	4,299,057	817,546	764	2,016,817	517,403	48,974	28,785	7,729,346

1/ Includes volume in logs, poles, pilings, cordwood, shingle bolts, etc., as compiled by Washington State Department of Natural Resources.

2/ Data on Region 6 National Forests were compiled by Pacific Northwest Forest and Range Experiment Station.

3/ Includes data on lands owned by cities, counties, public utility districts, and State lands not administered by Washington State Department of Natural Resources.

Table 28.–Log production by ownership and county in the State of Washington, 1966[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private	State	Bureau of Land Management	National Forest	Indian	Other public[2/]	Other Federal	Total
Western Washington:								
Clallam	189,890	43,626	--	76,781	30,672	786	664	342,419
Clark	25,085	17,155	--	--	--	65	--	42,305
Cowlitz	491,354	117,162	--	34,641	--	25	--	643,182
Grays Harbor	366,127	3,929	--	98,613	171,477	12,799	133	653,078
Island	15,890	--	--	--	--	--	--	15,890
Jefferson	224,038	159,852	--	65,298	4,744	771	241	454,944
King	230,048	13,269	--	58,298	--	33,147	--	334,762
Kitsap	17,889	1,221	--	--	54	1,005	--	20,169
Lewis	699,292	46,278	--	181,393	--	1,080	66	928,109
Mason	83,996	5,351	--	121,666	1,582	2,252	181	215,028
Pacific	517,101	11,235	--	--	--	29	4,457	532,822
Pierce	354,023	27,499	--	46,733	--	670	17,871	446,796
San Juan	3,201	--	--	--	--	--	--	3,201
Skagit	120,605	20,291	--	81,231	--	71	--	222,198
Skamania	89,393	538	--	418,467	--	--	--	508,398
Snohomish	115,735	40,951	1	120,458	--	--	--	277,145
Thurston	132,206	9,087	--	--	--	--	--	141,293
Wahkiakum	95,504	30,842	--	--	--	--	--	126,346
Whatcom	80,300	22,347	--	78,011	--	123	--	180,781
Total	3,851,677	570,633	1	1,381,590	208,529	52,823	23,613	6,088,866
Eastern Washington:								
Adams	--	--	--	--	--	--	--	--
Asotin	498	282	--	4,922	--	--	--	5,702
Benton	--	--	--	--	--	--	--	--
Chelan	17,203	2,328	--	77,050	--	--	65	96,646
Columbia	13,117	--	--	428	--	242	--	13,787
Douglas	--	--	--	--	--	--	--	--
Ferry	20,540	--	2,361	56,854	84,957	--	--	164,712
Franklin	--	--	--	--	--	--	--	--
Garfield	583	--	--	8,239	--	--	--	8,822
Grant	--	--	--	--	--	--	--	--
Kittitas	61,598	7,478	--	53,714	--	332	263	123,385
Klickitat	49,164	6,779	--	1,391	18,221	--	160	75,715
Lincoln	1,784	408	--	--	--	--	--	2,192
Okanogan	5,436	30,603	2,038	113,848	27,097	--	--	179,022
Pend Oreille	19,465	3,380	20	65,959	642	936	--	90,402
Spokane	14,694	159	--	--	--	70	118	15,041
Stevens	57,452	7,943	324	12,934	8,480	4,033	--	91,166
Walla Walla	5,742	--	--	214	--	--	--	5,956
Whitman	374	--	--	--	--	--	--	374
Yakima	19,785	10,912	--	62,595	136,837	--	--	230,129
Total	287,435	70,272	4,743	458,148	276,234	5,613	606	1,103,051
Total Washington	4,139,112	640,905	4,744	1,839,738	484,763	58,436	24,219	7,191,917

1/ Includes volume in logs, poles, pilings, cordwood, shingle bolts, etc., as compiled by Washington State Department of Natural Resources.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands not administered by Washington State Department of Natural Resources.

Table 29.–Log production by ownership and county in the State of Washington, 1967[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private	State	Bureau of Land Management	National Forest	Indian	Other public[2]	Other Federal	Total
Western Washington:								
Clallam	246,795	55,446	--	83,887	19,971	--	121	406,22
Clark	13,371	5,614	--	--	--	--	--	18,98
Cowlitz	453,289	59,891	--	20,519	--	--	--	533,69
Grays Harbor	305,172	5,773	--	93,180	201,019	18,379	772	624,29
Island	11,841	14	--	--	--	--	--	11,85
Jefferson	178,862	190,754	--	73,144	2,582	422	--	445,76
King	298,433	3,439	--	63,247	--	46,894	7,710	419,72
Kitsap	21,722	555	--	--	--	103	--	22,38
Lewis	694,311	17,305	--	181,654	--	1,334	--	894,60
Mason	66,196	5,050	--	101,629	--	253	--	173,12
Pacific	456,905	17,499	--	--	--	724	103	475,23
Pierce	310,894	14,401	--	73,989	--	3,999	13,553	416,83
San Juan	1,744	--	--	--	--	--	--	1,74
Skagit	148,622	20,286	--	83,765	--	310	--	252,98
Skamania	90,976	13,072	--	433,313	--	--	--	537,36
Snohomish	128,025	15,494	--	114,424	--	355	908	259,20
Thurston	72,183	15,133	--	--	--	302	1,158	88,77
Wahkiakum	107,439	17,666	--	--	--	46	--	125,15
Whatcom	86,199	19,258	--	66,989	39	--	--	172,48
Total	3,692,979	476,650	--	1,389,740	223,611	73,121	24,325	5,880,42
Eastern Washington:								
Adams	--	--	--	--	--	--	--	-
Asotin	1,665	--	--	--	--	--	--	1,66
Benton	--	--	--	--	--	--	--	-
Chelan	7,728	4,701	--	71,904	--	--	--	84,33
Columbia	7,165	94	--	11,021	--	--	--	18,28
Douglas	--	--	--	--	--	--	--	-
Ferry	14,660	5,632	2,542	54,437	79,066	7,594	--	163,93
Franklin	--	--	--	--	--	--	--	-
Garfield	323	--	--	13,696	--	--	--	14,01
Grant	--	--	--	--	--	--	--	-
Kittitas	60,969	6,416	--	41,944	--	--	--	109,33
Klickitat	60,155	8,669	--	1,498	16,808	728	--	87,85
Lincoln	48	--	--	--	--	--	--	4
Okanogan	5,863	24,699	849	129,791	41,190	--	--	202,39
Pend Oreille	15,652	4,370	4	70,417	6	--	--	90,44
Spokane	9,190	888	--	--	--	16	--	10,09
Stevens	51,317	11,590	247	15,318	17,386	--	--	95,85
Walla Walla	3,195	--	--	--	--	--	--	3,19
Whitman	--	--	--	--	--	--	--	-
Yakima	30,597	10,187	--	69,336	145,980	1,231	--	257,33
Total	268,527	77,246	3,642	479,362	300,436	9,569	--	1,138,78
Total Washington	3,961,506	553,896	3,642	1,869,102	524,047	82,690	24,325	7,019,21

1/ Includes volume in logs, poles, pilings, cordwood, shingle bolts, etc., as compiled by Washington State Departme of Natural Resources.

2/ Includes data on lands owned by cities, counties, public utility districts, and State lands not administered by Washington State Department of Natural Resources.

Table 30.–Log production by ownership and county in the State of Washington, 1968[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/]	Bureau of Land Management[3/]	National Forest[3/]	Indian[3/]	Other public[2/]	Other Federal[2/4/]	Total
ern Washington:								
allam	240,611	95,876	--	114,049	17,652	--	--	468,188
lark	32,081	5,774	--	--	--	--	--	37,855
owlitz	625,399	105,784	--	17,855	--	640	--	749,678
rays Harbor	346,753	11,744	--	130,687	243,542	18,900	--	751,626
sland	12,033	672	--	--	--	--	320	13,025
efferson	190,822	244,363	--	75,759	10	199	2,088	513,241
ing	304,706	20,500	--	52,619	--	42,824	--	420,649
itsap	23,782	1,141	--	--	--	571	688	26,182
ewis	793,418	31,632	--	199,804	--	--	5,866	1,030,720
ason	88,413	11,009	--	103,662	--	2,962	2,600	208,646
acific	659,361	28,590	--	--	--	--	4,674	692,625
ierce	335,653	12,245	--	50,351	--	3,336	28,448	430,033
an Juan	4,135	--	--	--	--	--	--	4,135
kagit	167,738	32,849	--	94,217	--	1,821	--	296,625
kamania	76,970	21,884	--	564,081	--	--	--	662,935
nohomish	104,922	26,806	--	134,113	--	982	415	267,238
urston	95,667	15,306	--	--	--	2,855	1,387	115,215
ahkiakum	120,467	7,839	--	--	--	--	--	128,306
hatcom	80,760	36,498	--	58,786	--	256	--	176,300
Total	4,303,691	710,512	--	1,595,983	261,204	75,346	46,486	6,993,222
ern Washington:								
lams	--	--	--	--	--	--	--	--
otin	1,908	--	--	5,155	--	--	--	7,063
nton	--	--	--	--	--	--	--	--
elan	13,674	--	--	77,809	--	--	--	91,483
lumbia	2,750	--	--	11,696	--	--	--	14,446
uglas	--	--	--	--	--	--	--	--
rry	27,905	9,684	632	37,430	117,709	--	--	193,360
anklin	--	--	--	--	--	--	--	--
rfield	836	--	--	8,173	--	--	--	9,009
ant	--	--	--	--	--	--	--	--
ttitas	64,653	7,302	--	78,534	--	--	--	150,489
ickitat	68,492	15,964	--	526	1,696	--	749	87,427
ncoln	550	18	--	--	--	--	--	568
anogan	9,380	23,231	1,639	130,100	36,524	--	--	200,874
nd Oreille	23,052	2,271	--	70,805	672	--	--	96,800
okane	13,564	1,382	--	--	--	302	291	15,539
evens	53,314	22,328	2,055	27,943	15,346	--	3,297	124,283
lla Walla	7,957	--	--	--	--	--	--	7,957
itman	--	--	--	--	--	--	--	--
kima	22,749	16,468	--	57,449	163,308	--	--	259,974
Total	310,784	98,648	4,326	505,620	335,255	302	4,337	1,259,272
Washington	4,614,475	809,160	4,326	2,101,603	596,459	75,648	50,823	8,252,494

1/ Includes volume in logs, poles, pilings, shingle bolts, etc.

2/ Compiled by Washington State Department of Natural Resources.

3/ Compiled by respective agencies, U.S. Bureau of Land Management, U.S. Forest Service, and U.S. Bureau of Indian fa s.

4/ Includes lands logged under jurisdiction of Bonneville Power Administration, National Park Service, U.S. Army, d S. Fish and Wildlife Service.

Table 31.–Log production by ownership and county in the State of Washington, 1969[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/]	Bureau of Land Management[3/]	National Forest[3/]	Indian[3/]	Other public[2/]	Other Federal[2/4/]	Total
Western Washington:								
Clallam	226,676	105,439	--	93,084	6,502	63	1,095	432,9
Clark	46,428	18,369	--	--	--	--	87	64,4
Cowlitz	521,132	103,157	--	12,445	--	--	4,223	640,7
Grays Harbor	527,377	18,374	--	72,668	203,370	34,316	--	856,5
Island	16,479	804	--	--	--	84	--	17,7
Jefferson	221,499	239,382	--	42,263	--	1,464	--	504,8
King	414,376	3,859	--	66,246	--	15,572	--	500,3
Kitsap	23,535	3,124	--	--	--	645	1,650	28,4
Lewis	656,184	53,534	--	255,017	--	--	36	964,1
Mason	90,730	18,365	--	91,731	--	2,817	--	203,3
Pacific	627,776	23,092	--	--	--	--	10	650.8
Pierce	379,935	16,135	--	80,346	--	410	19,489	496..5
San Juan	2,241	--	--	--	--	22	--	2 ,3
Skagit	267,238	41,491	--	55,436	--	2,413	--	366 8
Skamania	112,162	20,550	--	372,968	--	--	--	505 0
Snohomish	285,428	42,268	--	142,097	--	1,617	241	471 1
Thurston	127,250	15,364	--	--	--	--	164	142 8
Wahkiakum	121,471	18,413	--	--	--	3,862	--	143 6
Whatcom	103,627	23,736	--	34,243	--	--	8,830	170 6
Total	4,771,544	765,456	--	1,318,544	209,872	63,285	35,825	7,164 26
Eastern Washington:								
Adams	--	--	--	--	--	--	--	--
Asotin	8,536	739	--	376	--	--	--	9 51
Benton	--	--	--	--	--	--	--	--
Chelan	22,194	1,302	--	75,343	--	--	--	98 39
Columbia	2,311	--	--	16,468	--	--	--	18 79
Douglas	--	--	--	--	--	--	--	--
Ferry	19,911	2,433	176	42,619	80,609	385	--	146 33
Franklin	--	--	--	--	--	--	--	--
Garfield	484	--	--	15,371	--	--	--	15 55
Grant	--	--	--	--	--	--	--	--
Kittitas	50,834	16,004	--	30,819	--	109	--	97 66
Klickitat	63,351	18,079	--	4,086	--	--	--	85 16
Lincoln	4,569	930	--	--	--	--	--	5 99
Okanogan	17,584	30,218	935	111,192	19,527	--	--	179 56
Pend Oreille	23,240	7,033	6	66,277	551	75	--	97 82
Spokane	17,542	155	--	--	--	--	234	17 31
Stevens	47,946	15,915	1,299	17,914	13,691	--	4,601	101 66
Walla Walla	896	--	--	--	--	--	--	96
Whitman	107	--	--	--	--	--	--	07
Yakima	16,974	25,196	--	76,009	149,518	453	--	268 50
Total	296,479	118,004	2,416	456,474	263,896	1,022	4,835	1,14 26
Total Washington	5,068,023	883,460	2,416	1,775,018	473,768	64,307	40,660	8,30 52

1/ Includes volume in logs, poles, piling, shingle bolts, etc.

2/ Compiled by Washington State Department of Natural Resources.

3/ Compiled by respective agencies, U.S. Bureau of Land Management, U.S. Forest Service, and U.S. Bureau of Indian Affairs.

4/ Includes lands logged under jurisdiction of Bonneville Power Administration, National Park Service, U.S. Army, and U.S. Fish and Wildlife Service.

Table 32.–Log production by ownership and county in the State of Washington, 1970[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State[2]	Bureau of Land Management[3]	National Forest[3]	Indian[3]	Other public[2]	Other Federal[2,4]	Total
tern Washington:								
Clallam	227,715	112,060	--	66,515	22,395	79	--	428,764
Clark	18,715	9,299	--	--	--	--	121	28,135
Cowlitz	671,469	76,581	--	9,807	--	1,340	--	759,197
Grays Harbor	415,402	9,854	--	79,081	168,199	15,364	--	687,900
Island	17,814	1,103	--	--	--	28	--	18,945
Jefferson	179,650	230,599	--	41,923	--	175	268	452,615
King	452,228	11,340	--	76,765	73	16,753	--	557,159
Kitsap	31,477	2,349	--	--	--	357	932	35,115
Lewis	663,640	23,871	--	205,632	--	77	--	893,220
Mason	81,136	8,533	--	118,995	--	--	1,207	209,871
Pacific	701,591	17,073	--	--	--	--	--	718,664
Pierce	353,161	20,013	--	75,717	--	488	12,277	461,656
San Juan	2,156	--	--	--	--	--	--	2,156
Skagit	217,711	29,246	--	101,150	--	72	--	348,179
Skamania	101,311	20,280	--	359,527	--	12	--	481,130
Snohomish	138,118	44,084	--	106,788	--	121	22	289,133
Thurston	85,559	7,085	--	--	--	--	8,752	101,396
Wahkiakum	101,179	19,301	--	--	--	4,052	--	124,532
Whatcom	83,838	20,270	--	19,905	--	229	--	124,242
Total	4,543,870	662,941	--	1,261,805	190,667	39,147	23,579	6,722,009
ern Washington:								
dams	--	--	--	--	--	--	-	--
sotin	7,521	--	--	2,052	--	--	--	9,573
enton	--	--	--	--	--	--	--	--
helan	13,272	972	--	50,886	--	361	--	65,491
olumbia	2,836	--	--	9,415	--	--	-	12,251
ouglas	--	--	--	--	--	--	--	--
erry	25,958	1,749	--	48,277	68,360	--	--	144,344
ranklin	--	--	--	--	--	--	--	--
arfield	984	--	--	16,012	--	--	--	16,996
rant	--	--	--	--	--	--	--	--
ittitas	52,300	3,466	--	31,861	--	--	--	87,627
ickitat	63,615	9,521	--	3,418	630	--	--	77,184
incoln	762	65	--	--	--	--	--	827
anogan	10,792	23,294	5	50,797	25,629	--	-	110,517
nd Oreille	11,894	346	--	66,869	331	--	--	79,440
okane	19,548	21	--	--	--	321	268	20,158
evens	61,317	2,995	3,654	16,661	5,905	128	2,710	93,370
alla Walla	4,534	--	--	--	--	--	--	4,534
itman	--	--	1	--	--	--	--	1
kima	25,196	14,088	--	59,915	123,780	7,739	--	230,718
Total	300,529	56,517	3,660	356,163	224,635	8,549	2,978	953,031
ot Washington	4,844,399	719,458	3,660	1,617,968	415,302	47,696	26,557	7,675,040

1/ Includes volume in logs, poles, piling, shingle bolts, etc.

2/ Compiled by Washington State Department of Natural Resources.

3/ Compiled by respective agencies, U.S. Bureau of Land Management, U.S. Forest Service, and U.S. Bureau of Indian ff rs.

4/ Includes lands logged under jurisdiction of Bonneville Power Administration, National Park Service, U.S. Army, nd .S. Fish and Wildlife Service.

Table 33.–Log production by ownership and county in the State of Oregon, 1949[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/ 3/]	Bureau of Land Management[4/]	National Forest[5/]	Indian[6/]	Total
Western Oregon:						
Benton	226,200	1,121	5,942	229	--	233,492
Clackamas	347,362	--	4,068	90,781	--	442,211
Clatsop	174,933	20,742	--	--	--	195,675
Columbia	56,453	--	--	--	--	56,453
Coos	491,955	--	5,836	28,863	--	526,654
Curry	103,073	--	--	609	--	103,682
Douglas	1,045,846	11,892	88,128	76,369	14,484	1,236,719
Hood River	30,211	--	--	15,744	--	45,955
Jackson	385,246	--	8,369	38,398	--	432,013
Josephine	212,242	--	10,510	7,964	--	230,716
Lane	864,752	14,060	68,286	264,923	--	1,212,021
Lincoln	404,795	--	--	15,245	16,898	436,938
Linn	598,707	653	21,626	57,419	--	678,405
Marion	128,357	1,594	--	3,066	--	133,017
Multnomah	14,433	--	--	--	--	14,433
Polk	273,367	31	13,378	1,678	--	288,454
Tillamook	(7/)	760,805	1,837	30,573	--	793,215
Washington	61,900	133,441	--	--	--	195,341
Yamhill	128,434	--	5,258	410	--	134,102
Total	5,548,266	944,339	233,238	632,271	31,382	7,389,496
Eastern Oregon:						
Baker	257	--	--	11,590	--	11,847
Crook	3,634	--	914	84,769	--	89,317
Deschutes	245	--	1,049	31,995	--	33,289
Gilliam	--	--	--	--	--	--
Grant	90,923	--	1,016	73,203	--	165,142
Harney	(7/)	--	582	44,679	--	45,261
Jefferson	99,701	--	--	8,953	11,770	120,424
Klamath	141,623	603	411	43,448	98,440	284,525
Lake	28,455	--	863	13,605	--	42,923
Malheur	--	--	--	--	--	--
Morrow	15,534	--	--	18,544	--	34,078
Sherman	--	--	--	--	--	--
Umatilla	2,222	--	--	8,000	1,070	11,292
Union	24,222	--	--	301	--	24,523
Wallowa	40,154	--	--	9,194	--	49,348
Wasco	12,878	--	--	17,260	30,433	60,571
Wheeler	14,229	--	--	678	--	14,907
Total	474,077	603	4,835	366,219	141,713	987,447
Total Oregon	6,022,343	944,942	238,073	998,490	173,095	8,376,943

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

7/ Negligible.

Table 34.–Log production by ownership and county in the State of Oregon, 1950[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/ 3/]	Bureau of Land Management[4/]	National Forest[5/]	Indian[6/]	Total
Western Oregon:						
Benton	214,341	358	19,108	1,448	--	235,255
Clackamas	329,111	--	10,803	114,303	--	454,217
Clatsop	187,902	2,833	812	--	--	191,547
Columbia	65,851	43	--	--	--	65,894
Coos	544,940	818	79,949	36,814	--	662,521
Curry	227,620	--	--	5,431	--	233,051
Douglas	1,053,964	8,339	130,894	151,358	10,863	1,355,418
Hood River	36,336	--	--	24,261	--	60,597
Jackson	446,111	--	73,748	92,215	--	612,074
Josephine	260,932	--	19,172	18,708	--	298,812
Lane	1,084,473	7,955	85,217	364,393	--	1,542,038
Lincoln	278,451	78	--	8,690	33,798	321,017
Linn	619,275	3,874	26,134	45,987	--	695,270
Marion	113,860	2,923	9,719	41,762	--	168,264
Multnomah	25,512	--	--	--	--	25,512
Polk	277,262	--	13,766	5,794	--	296,822
Tillamook	(7/)	854,196	918	15,812	--	870,926
Washington	28,295	121,023	--	--	--	149,318
Yamhill	137,587	--	17,196	--	1,207	155,990
Total	5,931,823	1,002,440	487,436	926,976	45,868	8,394,543
Eastern Oregon:						
Baker	--	--	716	15,087	--	15,803
Crook	--	--	5,661	55,105	--	60,766
Deschutes	--	--	2,374	40,125	--	42,499
Gilliam	--	--	--	--	--	--
Grant	106,624	--	51	90,094	--	196,769
Harney	--	--	--	27,392	--	27,392
Jefferson	15,861	--	96	11,663	16,050	43,670
Klamath	126,924	200	3,848	78,645	81,320	290,937
Lake	--	--	300	86,456	--	86,756
Malheur	--	--	--	--	--	--
Morrow	14,940	--	--	14,873	--	29,813
Sherman	--	--	--	--	--	--
Umatilla	51,538	--	--	4,708	1,070	57,316
Union	28,639	--	--	13,482	--	42,121
Wallowa	51,299	--	--	11,021	--	62,320
Wasco	23,406	--	--	29,211	48,150	100,767
Wheeler	97,318	--	--	8,560	--	105,878
Total	516,549	200	13,046	486,422	146,590	1,162,807
Total Oregon	6,448,372	1,002,640	500,482	1,413,398	192,458	9,557,350

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

7/ Negligible

Table 35.–Log production by ownership and county in the State of Oregon, 1951[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/ 3/]	Bureau of Land Management[4/]	National Forest[5/]	Indian[6/]	Total
Western Oregon:						
Benton	227,555	380	7,021	5,069	--	240,025
Clackamas	327,463	--	24,939	139,650	--	492,052
Clatsop	205,958	7,570	--	--	--	213,528
Columbia	42,099	--	--	--	--	42,099
Coos	725,722	--	67,217	37,417	--	830,356
Curry	323,261	--	675	20,640	--	344,576
Douglas	1,332,855	8,941	109,227	155,944	--	1,606,967
Hood River	37,328	--	--	35,848	--	73,176
Jackson	523,925	--	40,214	77,248	--	641,387
Josephine	313,955	--	25,784	43,331	--	383,070
Lane	1,262,656	3,354	107,369	338,805	--	1,712,184
Lincoln	177,648	625	--	26,192	22,933	227,398
Linn	563,926	13,693	31,387	55,160	--	664,166
Marion	130,472	11,596	17,932	7,121	--	167,121
Multnomah	20,107	--	595	121	--	20,823
Polk	267,560	--	11,476	4,104	--	283,140
Tillamook	(7/)	717,744	637	21,726	--	740,107
Washington	11,373	110,218	--	--	--	121,591
Yamhill	134,322	--	42	--	--	134,364
Total	6,628,185	874,121	444,515	968,376	22,933	8,938,130
Eastern Oregon:						
Baker	23,561	--	--	5,243	--	28,804
Crook	--	--	50,220	52,323	--	102,543
Deschutes	9,384	--	1,552	41,837	--	52,773
Gilliam	2,789	--	--	--	--	2,789
Grant	138,595	--	44	91,164	--	229,803
Harney	8,395	--	--	39,804	--	48,199
Jefferson[7/]	104,832	--	--	10,700	(8/)	115,532
Klamath	111,042	292	4,640	39,376	105,930	261,280
Lake	27,017	--	107	75,221	--	102,345
Malheur	--	--	--	--	--	--
Morrow	15,906	--	--	14,766	--	30,672
Sherman	--	--	--	--	--	--
Umatilla	58,754	--	--	5,350	1,070	65,174
Union	35,850	--	--	4,815	--	40,665
Wallowa	50,028	--	--	13,589	--	63,617
Wasco	33,242	--	--	38,413	8/ 63,130	134,785
Wheeler	110,511	--	--	10,807	--	121,318
Total	729,906	292	56,563	443,408	170,130	1,400,299
Total Oregon	7,358,091	874,413	501,078	1,411,784	193,063	10,338,429

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

7/ Negligible.

8/ Production in Wasco and Jefferson Counties combined.

Table 36.–Log production by ownership and county in the State of Oregon, 1952[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State[2] [3]	Bureau of Land Management[4]	National Forest[5]	Indian[6]	Total
Western Oregon:						
Benton	200,678	--	13,268	7,001	--	220,947
Clackamas	363,739	--	7,363	118,165	--	489,267
Clatsop	206,749	1,852	41	--	--	208,642
Columbia	60,870	6	775	--	--	61,651
Coos	841,054	--	18,052	35,969	--	895,075
Curry	751,100	344	--	21,123	--	772,567
Douglas	1,615,807	--	166,927	149,547	--	1,932,281
Hood River	30,519	--	--	30,416	--	60,935
Jackson	555,864	--	37,241	84,490	--	677,595
Josephine	316,237	--	28,412	35,727	--	380,376
Lane	1,327,516	2,442	120,869	393,965	--	1,844,792
Lincoln	617,928	--	--	28,847	17,487	664,262
Linn	580,696	9,305	21,232	100,785	--	712,018
Marion	96,789	4,502	10,643	35,606	--	147,540
Multnomah	24,507	--	--	--	--	24,507
Polk	229,486	--	15,884	13,518	--	258,888
Tillamook	35,404	655,511	5,417	38,745	--	735,077
Washington	94,337	60,438	4,647	--	--	159,422
Yamhill	138,342	--	10,856	483	--	149,681
Total	8,087,622	734,400	461,627	1,094,387	17,487	10,395,523
Eastern Oregon:						
Baker	32,485	--	--	8,132	--	40,617
Crook	12,264	--	--	60,027	--	72,291
Deschutes	17,275	--	3,442	41,409	--	62,126
Gilliam	--	--	--	--	--	--
Grant	130,441	--	--	118,449	--	248,890
Harney	8,646	--	--	23,433	--	32,079
Jefferson	53,281	--	--	16,264	13,746	83,291
Klamath	96,573	129	9,377	44,726	60,350	211,155
Lake	51,146	--	--	73,081	--	124,227
Malheur	--	--	--	--	--	--
Morrow	8,581	--	--	3,424	--	12,005
Sherman	--	--	--	--	--	--
Umatilla	32,984	--	--	5,136	5,250	43,370
Union	47,131	--	--	4,815	--	51,946
Wallowa	36,276	--	--	22,363	--	58,639
Wasco	20,544	--	--	40,660	49,584	110,788
Wheeler	47,595	--	--	18,083	--	65,678
Total	595,222	129	12,819	480,002	128,930	1,217,102
Total Oregon	8,682,844	734,529	474,446	1,574,389	146,417	11,612,625

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

Table 37.–Log production by ownership and county in the State of Oregon, 1953[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/ 3/]	Bureau of Land Management[4/]	National Forest[5/]	Indian[6/]	Total
Western Oregon:						
Benton	194,354	--	8,273	8,208	--	210,835
Clackamas	281,327	--	16,048	171,152	--	468,527
Clatsop	172,914	12,661	--	--	--	185,575
Columbia	80,275	--	--	--	--	80,275
Coos	732,114	132	37,337	42,728	--	812,311
Curry	401,965	--	--	18,588	--	420,553
Douglas	1,414,061	240	187,649	177,308	--	1,779,258
Hood River	41,264	--	--	36,934	--	78,198
Jackson	403,279	--	39,719	101,509	--	544,507
Josephine	260,384	--	19,411	14,122	--	293,917
Lane	997,278	3,545	150,869	414,604	--	1,566,296
Lincoln	504,735	--	--	19,433	817	524,985
Linn	463,233	3,810	60,870	119,734	--	647,647
Marion	112,743	18,206	--	64,333	--	195,282
Multnomah	15,819	--	--	121	--	15,940
Polk	126,935	--	12,189	16,898	29	156,051
Tillamook	(7/)	545,655	2,669	45,625	--	593,949
Washington	107,295	60,460	--	--	--	167,755
Yamhill	51,690	--	5,749	--	76	57,515
Total	6,361,665	644,709	540,783	1,251,297	922	8,799,376
Eastern Oregon:						
Baker	34,550	--	--	22,684	--	57,234
Crook	13,193	--	367	53,072	--	66,632
Deschutes	8,768	--	149	49,862	--	58,779
Gilliam	--	--	--	--	--	--
Grant	107,899	--	5,681	99,403	--	212,983
Harney	6,360	--	--	21,614	--	27,974
Jefferson	48,077	--	--	20,972	14,124	83,173
Klamath	93,509	--	10,450	60,134	67,063	231,156
Lake	67,247	--	--	91,378	--	158,625
Malheur	--	--	--	428	--	428
Morrow	2,880	--	383	8,346	--	11,609
Sherman	--	--	--	--	--	--
Umatilla	49,373	--	--	5,671	12,977	68,021
Union	50,371	--	--	963	318	51,652
Wallowa	57,621	--	--	15,729	--	73,350
Wasco	15,519	--	--	50,932	40,556	107,007
Wheeler	106,816	--	--	14,231	--	121,047
Total	662,183	--	17,030	515,419	135,038	1,329,670
Total Oregon	7,023,848	644,709	557,813	1,766,716	135,960	10,129,046

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

7/ Negligible.

Table 38.–Log production by ownership and county in the State of Oregon, 1954[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/ 3/]	Bureau of Land Management[4/]	National Forest[5/]	Indian[6/]	Total
Western Oregon:						
Benton	166,290	303	27,477	21,605	--	215,675
Clackamas	285,008	--	15,877	140,133	--	441,018
Clatsop	155,318	3,983	--	--	--	159,301
Columbia	52,162	--	13,096	--	--	65,258
Coos	597,518	358	91,833	26,433	--	716,142
Curry	447,380	--	--	29,692	--	477,072
Douglas	1,376,650	1,352	267,539	247,073	--	1,892,614
Hood River	26,661	--	--	43,211	--	69,872
Jackson	604,376	--	51,984	145,202	--	801,562
Josephine	251,650	--	50,104	32,951	--	334,705
Lane	895,544	4,575	128,432	471,816	--	1,500,367
Lincoln	452,116	407	671	34,762	690	488,646
Linn	463,676	4,968	41,897	134,460	--	645,001
Marion	47,693	27,862	15,636	38,383	--	129,574
Multnomah	19,716	--	--	1,448	--	21,164
Polk	200,432	127	19,694	15,691	--	235,944
Tillamook	--	490,194	6,173	28,244	--	524,611
Washington	86,245	36,229	2,217	--	--	124,691
Yamhill	77,537	--	10,338	--	--	87,875
Total	6,205,972	570,358	742,968	1,411,104	690	8,931,092
Eastern Oregon:						
Baker	40,910	--	--	35,631	--	76,541
Crook	15,009	--	3,639	74,686	--	93,334
Deschutes	12,834	--	1,953	60,027	--	74,814
Gilliam	535	--	--	--	--	535
Grant	132,209	--	--	129,470	--	261,679
Harney	16,831	--	607	34,561	--	51,999
Jefferson	29,095	--	--	16,050	14,365	59,510
Klamath	117,752	--	7,149	37,450	44,947	207,298
Lake	42,329	--	4,147	87,954	--	134,430
Malheur	1,979	--	--	3,531	--	5,510
Morrow	26,302	--	--	214	--	26,516
Sherman	--	--	--	--	--	--
Umatilla	84,802	--	1,026	14,338	8,833	108,999
Union	63,229	--	--	3,317	2,924	69,470
Wallowa	91,784	--	--	24,075	--	115,859
Wasco	16,749	--	--	50,611	45,967	113,327
Wheeler	104,901	--	308	16,906	--	122,115
Total	797,250	--	18,829	588,821	117,036	1,521,936
Total Oregon	7,003,222	570,358	761,797	1,999,925	117,726	10,453,028

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

Table 39.–Log production by ownership and county in the State of Oregon, 1955[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/ 3/]	Bureau of Land Management[4/]	National Forest[5/]	Indian[6/]	Total
Western Oregon:						
Benton	170,607	3,098	24,389	9,043	--	207,137
Clackamas	262,773	--	25,205	215,754	--	503,732
Clatsop	287,520	5,520	--	--	--	293,040
Columbia	69,038	--	6,509	--	--	75,547
Coos	795,742	881	95,877	19,934	--	912,434
Curry	377,967	--	4,509	37,305	--	419,781
Douglas	1,902,327	267	184,013	265,476	--	2,352,083
Hood River	34,207	--	--	37,652	--	71,859
Jackson	680,908	--	57,052	110,285	--	848,245
Josephine	305,081	--	15,415	31,727	--	352,223
Lane	869,210	2,810	87,862	501,318	--	1,461,200
Lincoln	660,147	1,961	1,371	72,888	--	736,367
Linn	428,183	2,956	39,922	105,711	--	576,772
Marion	59,267	3,075	6,112	16,916	--	85,370
Multnomah	15,835	--	--	404	--	16,239
Polk	196,987	4,873	16,862	12,521	--	231,243
Tillamook	12,731	447,685	756	27,195	--	488,367
Washington	33,707	62,094	6,775	--	--	102,576
Yamhill	85,544	--	2,834	57	--	88,435
Total	7,247,781	535,220	575,463	1,464,186	--	9,822,650
Eastern Oregon:						
Baker	32,126	--	1,621	48,679	--	82,426
Crook	10,851	--	448	48,639	--	59,938
Deschutes	9,981	--	203	41,372	--	51,556
Gilliam	--	--	--	--	--	--
Grant	171,069	--	3,843	126,558	--	301,470
Harney	16,193	--	722	30,217	--	47,132
Jefferson	50,853	--	--	42,372	11,483	104,708
Klamath	206,776	--	6,829	41,363	66,708	321,676
Lake	43,842	--	10,452	82,698	19,630	156,622
Malheur	462	--	137	--	--	599
Morrow	39,713	--	--	27	--	39,740
Sherman	--	--	--	--	--	--
Umatilla	58,197	--	149	25,804	9	84,159
Union	56,623	--	188	5,364	--	62,175
Wallowa	60,966	--	--	24,533	--	85,499
Wasco	20,240	--	--	64,250	44,913	129,403
Wheeler	71,261	--	2,309	11,594	--	85,164
Total	849,153	--	26,901	593,470	142,743	1,612,267
Total Oregon	8,096,934	535,220	602,364	2,057,656	142,743	11,434,917

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

Table 40.–Log production by ownership and county in the State of Oregon, 1956 [1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State[2] [3]	Bureau of Land Management[4]	National Forest[5]	Indian[6]	Total
Western Oregon:						
Benton	197,597	2,076	13,062	24,985	--	237,720
Clackamas	279,789	2,130	20,398	197,465	--	499,782
Clatsop	267,606	22,588	--	--	--	290,194
Columbia	142,990	241	433	--	--	143,664
Coos	573,566	293	43,059	29,451	--	646,369
Curry	415,735	64	4,814	46,107	--	466,720
Douglas	1,623,904	3,439	202,387	286,662	--	2,116,392
Hood River	35,798	--	--	43,211	--	79,009
Jackson	518,000	--	59,102	93,542	--	670,644
Josephine	270,580	--	23,778	24,623	--	318,981
Lane	729,045	1,102	102,878	489,559	--	1,322,584
Lincoln	634,702	2,962	3,450	49,366	--	690,480
Linn	515,182	888	41,912	104,888	--	662,870
Marion	66,378	135	3,872	25,830	--	96,215
Multnomah	20,822	--	--	1,207	--	22,029
Polk	237,138	4,904	22,602	--	--	264,644
Tillamook	100,655	344,738	6,515	46,470	--	498,378
Washington	70,170	42,245	1,352	--	--	113,767
Yamhill	92,053	--	2,263	--	--	94,316
Total	6,791,710	427,805	551,877	1,463,366	--	9,234,758
Eastern Oregon:						
Baker	50,795	--	619	54,784	--	106,198
Crook	15,171	--	365	71,904	--	87,440
Deschutes	--	--	4,068	86,028	--	90,096
Gilliam	--	--	--	--	--	--
Grant	174,541	--	4,224	126,046	--	304,811
Harney	24,117	--	2,012	35,524	--	61,653
Jefferson	59,238	--	--	34,882	13,310	107,430
Klamath	58,003	--	5,565	53,821	80,816	198,205
Lake	110,121	--	2,024	90,308	50,378	252,831
Malheur	--	--	137	--	--	137
Morrow	46,042	--	--	8,025	--	54,067
Sherman	--	--	--	--	--	--
Umatilla	69,040	--	--	14,445	3	83,488
Union	71,733	--	201	23,540	--	95,474
Wallowa	66,269	--	767	26,750	--	93,786
Wasco	33,363	--	--	61,525	29,410	124,298
Wheeler	60,303	--	2,813	13,482	--	76,598
Total	838,736	--	22,795	701,064	173,917	1,736,512
Total Oregon	7,630,446	427,805	574,672	2,164,430	173,917	10,971,270

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

Table 41.–Log production by ownership and county in the State of Oregon, 1957[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/ 3/]	Bureau of Land Management[4/]	National Forest[5/]	Indian[6/]	Total
Western Oregon:						
Benton	122,230	257	13,589	16,536	--	152,612
Clackamas	236,570	1,064	21,522	141,581	--	400,737
Clatsop	185,553	23,536	--	--	--	209,089
Columbia	127,980	--	3,094	--	--	131,074
Coos	486,321	1,060	42,756	38,624	--	568,761
Curry	495,773	217	1,024	33,555	--	530,569
Douglas	1,107,919	7,194	236,125	204,828	--	1,556,066
Hood River	40,311	--	--	33,434	--	73,745
Jackson	385,150	--	36,021	94,508	--	515,679
Josephine	171,869	--	39,996	22,209	--	234,074
Lane	620,918	4,262	83,780	450,090	--	1,159,050
Lincoln	523,103	4,680	976	43,935	--	572,694
Linn	365,537	8,815	61,615	139,891	--	575,858
Marion	34,359	606	10,620	7,725	--	53,310
Multnomah	9,856	--	578	241	--	10,675
Polk	126,448	468	41,434	483	--	168,833
Tillamook	1,260	269,429	5,731	66,023	--	342,443
Washington	34,769	42,245	3,640	--	--	80,654
Yamhill	57,662	--	4,147	--	--	61,809
Total	5,133,588	363,833	606,648	1,293,663	--	7,397,732
Eastern Oregon:						
Baker	26,288	--	3,452	65,163	--	94,903
Crook	23,645	--	1,658	34,989	--	60,292
Deschutes	28,814	--	956	62,274	--	92,044
Gilliam	--	--	--	--	--	--
Grant	125,910	--	603	99,403	--	225,916
Harney	1,498	--	1,380	23,005	--	25,883
Jefferson	32,943	--	--	28,890	4	61,837
Klamath	97,334	16	14,788	72,974	9,619	194,731
Lake	62,511	--	--	101,436	19	163,966
Malheur	--	--	--	--	--	--
Morrow	59,145	--	--	3,210	--	62,355
Sherman	--	--	--	--	--	--
Umatilla	63,891	766	--	15,408	7,703	87,768
Union	94,247	--	703	34,133	--	129,083
Wallowa	83,497	--	--	23,112	--	106,609
Wasco	52,363	--	622	42,158	38,632	133,775
Wheeler	450	--	245	21,293	--	21,988
Total	752,536	782	24,407	627,448	55,977	1,461,150
Total Oregon	5,886,124	364,615	631,055	1,921,111	55,977	8,858,882

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

Table 42.–Log production by ownership and county in the State of Oregon, 1958[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State[2] [3]	Bureau of Land Management[4]	National Forest[5]	Indian[6]	Total
Western Oregon:						
Benton	107,263	1,957	28,214	10,288	--	147,722
Clackamas	185,677	11	22,078	220,898	--	428,664
Clatsop	231,201	11,034	--	--	--	242,235
Columbia	91,596	--	6,731	--	--	98,327
Coos	577,968	699	59,300	52,273	--	690,240
Curry	451,605	--	987	46,331	--	498,923
Douglas	1,031,813	13,241	273,352	286,711	--	1,605,117
Hood River	46,123	--	--	58,531	--	104,654
Jackson	300,072	--	91,454	139,497	--	531,023
Josephine	40,985	--	41,660	54,594	--	137,239
Lane	594,187	2,428	138,471	582,713	--	1,317,799
Lincoln	278,076	11,950	2,350	92,456	--	384,832
Linn	281,163	2,240	39,955	139,933	--	463,291
Marion	51,210	3,346	9,378	43,320	--	107,254
Multnomah	4,967	--	485	4,664	--	10,116
Polk	139,824	2,274	27,846	--	--	169,944
Tillamook	182,829	90,118	14,340	44,582	--	331,869
Washington	46,165	763	3,154	--	--	50,082
Yamhill	64,800	--	7,473	--	--	72,273
Total	4,707,524	140,061	767,228	1,776,791	--	7,391,604
Eastern Oregon:						
Baker	40,978	--	5,575	55,681	--	102,234
Crook	36,988	--	192	48,843	--	86,023
Deschutes	14,933	--	902	80,903	--	96,738
Gilliam	--	--	--	--	--	--
Grant	162,741	--	9,644	84,752	--	257,137
Harney	4,321	--	70	45,362	--	49,753
Jefferson	17,639	1,170	833	36,508	25,725	81,875
Klamath	103,180	--	11,832	61,616	41,072	217,700
Lake	49,213	--	--	119,134	--	168,347
Malheur	--	--	--	--	--	--
Morrow	52,677	--	--	15,303	--	67,980
Sherman	--	--	--	--	--	--
Umatilla	71,151	1,703	--	19,424	6,691	98,969
Union	61,731	--	--	43,414	228	105,373
Wallowa	61,725	--	--	32,785	--	94,510
Wasco	45,809	--	--	51,433	32,137	129,379
Wheeler	20,323	--	2,589	24,582	--	47,494
Total	743,409	2,873	31,637	719,740	105,853	1,603,512
otal Oregon	5,450,933	142,934	798,865	2,496,531	105,853	8,995,116

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

Table 43.–Log production by ownership and county in the State of Oregon, 1959[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State[2] [3]	Bureau of Land Management[4]	National Forest[5]	Indian[6]	Total
Western Oregon:						
Benton	89,068	3,937	52,281	14,504	--	159,790
Clackamas	188,734	2,187	32,354	313,372	--	536,647
Clatsop	249,321	33,077	--	--	--	282,398
Columbia	92,326	--	4,276	--	--	96,602
Coos	604,637	13,031	86,264	78,065	--	781,997
Curry	570,724	--	9,011	113,062	--	692,797
Douglas	1,119,722	11,762	367,236	396,304	--	1,895,024
Hood River	36,572	72	--	76,361	--	113,005
Jackson	357,725	--	84,401	162,119	--	604,245
Josephine	90,376	--	69,941	81,270	--	241,587
Lane	430,408	5,746	131,166	740,013	--	1,307,333
Lincoln	310,049	7,440	3,564	191,402	--	512,455
Linn	311,598	1,591	60,352	179,690	--	553,231
Marion	38,949	8,119	15,323	71,864	--	134,255
Multnomah	5,057	--	--	15,130	--	20,187
Polk	173,672	220	34,284	4,017	--	212,193
Tillamook	163,391	74,582	23,550	60,486	--	322,009
Washington	42,086	2,250	881	--	--	45,217
Yamhill	52,501	--	15,663	--	--	68,164
Total	4,926,916	164,014	990,547	2,497,659	--	8,579,136
Eastern Oregon:						
Baker	47,102	--	7,040	71,674	--	125,816
Crook	20,548	--	1,427	65,809	--	87,784
Deschutes	1,756	--	1,526	93,703	--	96,985
Gilliam	--	--	--	--	--	--
Grant	146,012	--	4,707	141,137	--	291,856
Harney	--	--	205	43,562	--	43,767
Jefferson	8,643	--	--	62,505	24,779	95,927
Klamath	172,425	--	17,360	71,264	3,649	264,698
Lake	40,496	--	884	143,699	--	185,079
Malheur	2,311	--	--	--	--	2,311
Morrow	60,122	--	--	18,421	--	78,543
Sherman	--	--	--	--	--	--
Umatilla	76,342	2,006	--	36,601	4,922	119,871
Union	86,454	--	--	31,428	--	117,882
Wallowa	74,763	--	--	36,410	--	111,173
Wasco	29,799	--	--	48,635	47,604	126,038
Wheeler	26,823	--	5,627	61,138	--	93,588
Total	793,596	2,006	38,776	925,986	80,954	1,841,318
Total Oregon	5,720,512	166,020	1,029,323	3,423,645	80,954	10,420,454

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

Table 44.–Log production by ownership and county in the State of Oregon, 1960[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/ 3/]	Bureau of Land Management[4/]	National Forest[5/]	Indian[6/]	Total
Western Oregon:						
Benton	94,778	8,340	39,182	10,185	--	152,485
Clackamas	149,361	338	17,033	250,733	--	417,465
Clatsop	256,429	49,062	--	--	--	305,491
Columbia	112,985	75	1,642	--	--	114,702
Coos	667,072	17,109	84,686	30,124	--	798,991
Curry	434,702	--	7,596	116,958	--	559,256
Douglas	1,211,899	17,967	297,874	293,679	--	1,821,419
Hood River	45,377	--	--	42,520	--	87,897
Jackson	356,882	--	70,092	112,321	--	539,295
Josephine	53,167	--	72,763	64,565	--	190,495
Lane	843,662	4,975	127,832	584,718	--	1,561,187
Lincoln	370,270	6,852	5,975	139,804	--	522,901
Linn	256,461	4,401	48,562	186,599	--	496,023
Marion	47,006	8,025	23,949	44,391	--	123,371
Multnomah	19,068	--	--	15,115	--	34,183
Polk	64,842	192	28,193	--	--	93,227
Tillamook	190,745	88,175	27,898	45,042	--	351,860
Washington	27,245	879	--	--	--	28,124
Yamhill	29,497	--	11,645	6,240	--	47,382
Total	5,231,448	206,390	864,922	1,942,994	--	8,245,754
Eastern Oregon:						
Baker	17,232	--	1,806	46,531	--	65,569
Crook	5,721	--	--	55,442	--	61,163
Deschutes	6,684	--	2,787	72,837	--	82,308
Gilliam	--	--	--	--	--	--
Grant	55,339	1,691	8,151	127,324	--	192,505
Harney	1,236	--	2,033	51,986	--	55,255
Jefferson	1,046	--	--	29,503	19,645	50,194
Klamath	145,206	505	29,416	85,465	--	260,592
Lake	137,003	--	2,531	73,609	--	213,143
Malheur	27	--	508	--	--	535
Morrow	56,439	--	--	18,039	--	74,478
Sherman	--	--	--	--	--	--
Umatilla	60,248	--	--	33,475	4,953	98,676
Union	41,575	1,511	1,158	42,701	--	86,945
Wallowa	64,950	--	1,293	36,066	--	102,309
Wasco	49,093	--	2,460	59,208	56,660	167,421
Wheeler	24,604	--	--	22,348	--	46,952
Total	666,403	3,707	52,143	754,534	81,258	1,558,045
Total Oregon	5,897,851	210,097	917,065	2,697,528	81,258	9,803,799

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

Table 45.–Log production by ownership and county in the State of Oregon, 1961[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/ 3/]	Bureau of Land Management[4/]	National Forest[5/]	Indian[6/]	Total
Western Oregon:						
Benton	80,824	3,249	22,755	17,019	--	123,847
Clackamas	129,876	1,161	15,819	223,713	--	370,569
Clatsop	202,118	54,163	--	--	--	256,281
Columbia	41,808	1,176	1,774	--	--	44,758
Coos	397,497	32,612	62,764	28,602	--	521,475
Curry	391,277	22	11,211	110,314	--	512,824
Douglas	574,788	33,004	304,487	332,817	--	1,245,096
Hood River	46,893	--	--	38,763	--	85,656
Jackson	241,980	--	108,953	146,854	--	497,787
Josephine	58,673	--	57,207	45,892	--	161,772
Lane	982,396	9,208	164,588	604,960	--	1,761,152
Lincoln	248,128	5,471	7,155	120,963	--	381,717
Linn	412,992	1,504	62,220	176,899	--	653,615
Marion	28,008	2,943	16,647	79,634	--	127,232
Multnomah	7,845	--	--	28,538	--	36,383
Polk	30,170	2,608	29,963	438	--	63,179
Tillamook	108,699	67,475	29,603	38,123	--	243,900
Washington	10,175	1,937	--	--	--	12,112
Yamhill	20,015	--	22,462	--	--	42,477
Total	4,014,162	216,533	917,608	1,993,529	--	7,141,832
Eastern Oregon:						
Baker	8,749	--	938	36,443	--	46,130
Crook	5,247	--	1,975	73,028	--	80,250
Deschutes	--	--	3,417	93,004	--	96,421
Gilliam	45	--	--	--	--	45
Grant	64,538	487	11,883	146,829	--	223,737
Harney	--	--	1,339	45,999	--	47,338
Jefferson	11,620	--	942	41,275	363	54,200
Klamath	87,732	1,766	11,431	94,019	--	194,948
Lake	99,693	--	--	83,634	--	183,327
Malheur	--	--	1,318	--	--	1,318
Morrow	39,512	--	--	5,378	--	44,890
Sherman	--	--	--	--	--	--
Umatilla	85,518	58	--	32,966	3,019	121,561
Union	44,812	--	--	80,154	--	124,966
Wallowa	70,232	--	317	27,947	--	98,496
Wasco	37,457	--	--	54,595	40,099	132,151
Wheeler	10,893	--	38	30,713	--	41,644
Total	566,048	2,311	33,598	845,984	43,481	1,491,422
Total Oregon	4,580,210	218,844	951,206	2,839,513	43,481	8,633,254

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

Table 46.–Log production by ownership and county in the State of Oregon, 1962[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State[2] [3]	Bureau of Land Management[4]	National Forest[5]	Indian[6]	Total
Western Oregon:						
Benton	53,860	5,282	35,052	7,363	--	101,557
Clackamas	144,778	212	40,695	251,780	--	437,465
Clatsop	256,003	29,379	--	--	--	285,382
Columbia	44,259	--	--	--	--	44,259
Coos	404,217	31,273	136,461	40,676	--	612,627
Curry	460,807	241	9,041	121,545	--	591,634
Douglas	722,169	32,210	361,342	426,674	--	1,542,395
Hood River	23,289	--	--	65,178	--	88,467
Jackson	262,237	--	79,185	189,016	--	530,438
Josephine	46,062	--	122,401	73,386	--	241,849
Lane	970,655	6,101	178,908	882,800	--	2,038,464
Lincoln	261,151	8,690	14,365	182,016	--	466,222
Linn	396,612	--	54,829	286,904	--	738,345
Marion	11,720	10,018	11,853	94,387	--	127,978
Multnomah	11,369	--	161	29,692	--	41,222
Polk	71,561	623	30,047	724	--	102,955
Tillamook	123,420	75,900	44,896	30,054	--	274,270
Washington	21,049	2,373	4,962	--	--	28,384
Yamhill	8,549	--	27,710	--	--	36,259
Total	4,293,767	202,302	1,151,908	2,682,195	--	8,330,172
Eastern Oregon:						
Baker	6,998	--	6,268	63,023	--	76,289
Crook	14,464	--	2,636	105,823	--	122,923
Deschutes	11,640	--	1,723	64,628	--	77,991
Gilliam	--	--	--	--	--	--
Grant	40,210	--	1,909	143,487	--	185,606
Harney	--	--	15	53,607	--	53,622
Jefferson	2,466	--	--	47,294	11,882	61,642
Klamath	145,464	--	7,883	112,778	--	266,125
Lake	78,701	--	--	100,045	--	178,746
Malheur	--	--	--	--	--	--
Morrow	25,315	--	--	22,256	--	47,571
Sherman	--	--	--	--	--	--
Umatilla	118,862	--	--	35,738	--	154,600
Union	37,773	--	--	72,439	12,604	122,816
Wallowa	59,046	--	471	29,211	--	88,728
Wasco	26,557	1,477	5	45,261	32,253	105,553
Wheeler	12,223	--	5	16,799	--	29,027
Total	579,719	1,477	20,915	912,389	56,739	1,571,239
Total Oregon	4,873,486	203,779	1,172,823	3,594,584	56,739	9,901,411

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

Table 47.–Log production by ownership and county in the State of Oregon, 1963[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/ 3/]	Bureau of Land Management[4/]	National Forest[5/]	Indian[6/]	Total
Western Oregon:						
Benton	55,384	10,712	42,830	48,159	--	157,085
Clackamas	124,837	3,026	24,815	256,246	--	408,924
Clatsop	237,538	49,996	--	--	--	287,534
Columbia	114,285	1,429	1,622	--	--	117,336
Coos	406,519	33,962	205,527	66,144	--	712,152
Curry	385,387	10,765	58,238	129,511	--	583,901
Douglas	605,094	14,273	426,632	452,504	--	1,498,503
Hood River	22,395	350	--	41,400	--	64,145
Jackson	189,501	32	97,554	240,314	--	527,401
Josephine	22,680	2,683	85,019	102,836	--	213,218
Lane	705,382	8,646	296,071	846,228	--	1,856,327
Lincoln	342,748	3,465	9,551	161,135	--	516,899
Linn	456,809	756	75,250	207,483	--	740,298
Marion	12,462	28,794	16,173	104,526	--	161,955
Multnomah	5,987	--	437	28,365	--	34,789
Polk	122,017	3,547	56,095	3,259	--	184,918
Tillamook	118,194	77,144	19,526	64,333	--	279,197
Washington	27,011	2,585	1,002	--	--	30,598
Yamhill	13,030	75	11,383	241	--	24,729
Total	3,967,260	252,240	1,427,725	2,752,684	--	8,399,909
Eastern Oregon:						
Baker	3,194	--	821	65,484	--	69,499
Crook	2,418	--	1,231	97,370	--	101,019
Deschutes	10,857	--	229	52,965	--	64,051
Gilliam	--	--	--	--	--	--
Grant	53,516	4,173	4,059	229,194	--	290,942
Harney	2,140	--	1,757	26,001	--	29,898
Jefferson	6,389	--	234	26,322	51,252	84,197
Klamath	134,450	--	14,193	143,701	--	292,344
Lake	74,889	--	--	109,889	--	184,778
Malheur	--	--	--	107	--	107
Morrow	19,127	--	--	5,778	--	24,905
Sherman	--	--	--	--	--	--
Umatilla	52,984	--	--	53,928	5,493	112,405
Union	44,973	294	--	77,254	--	122,521
Wallowa	67,835	--	191	78,859	--	146,885
Wasco	36,921	1,498	147	60,669	19,301	118,536
Wheeler	14,604	--	96	6,848	--	21,548
Total	524,297	5,965	22,958	1,034,369	76,046	1,663,635
Total Oregon	4,491,557	258,205	1,450,683	3,787,053	76,046	10,063,544

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

Table 48.–Log production by ownership and county in the State of Oregon, 1964[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State[2] [3]	Bureau of Land Management[4]	National Forest[5]	Indian[6]	Total
Western Oregon:						
Benton	45,517	5,301	75,312	25,950	--	152,080
Clackamas	126,267	4,416	23,520	248,642	--	402,845
Clatsop	308,786	42,780	--	--	--	351,566
Columbia	141,862	2,156	2,209	--	--	146,227
Coos	431,666	65,342	274,201	87,387	--	858,596
Curry	312,988	--	26,020	134,580	--	473,588
Douglas	775,874	45,900	466,306	573,687	--	1,861,767
Hood River	15,992	--	--	41,159	--	57,151
Jackson	225,601	664	120,620	198,552	--	545,437
Josephine	18,907	19	110,711	82,438	--	212,075
Lane	729,922	8,275	336,078	894,387	--	1,968,662
Lincoln	388,028	11,683	10,807	153,530	--	564,048
Linn	406,686	5,804	130,695	196,500	--	739,685
Marion	21,590	10,558	17,001	98,491	--	147,640
Multnomah	6,438	--	--	49,487	--	55,925
Polk	79,992	6,203	59,888	5,673	--	151,756
Tillamook	113,874	74,192	30,756	66,023	--	284,845
Washington	15,702	2,199	5,467	--	--	23,368
Yamhill	21,490	6,600	25,691	--	--	53,781
Total	4,187,182	292,092	1,715,282	2,856,486	--	9,051,042
Eastern Oregon:						
Baker	6,690	12	291	111,387	--	118,380
Crook	15,501	--	--	95,123	--	110,624
Deschutes	26,730	--	--	94,588	--	121,318
Gilliam	--	--	--	--	--	--
Grant	66,490	--	1,328	219,243	--	287,061
Harney	--	--	75	62,060	--	62,135
Jefferson	128	--	--	20,330	78,379	98,837
Klamath	134,126	969	21,324	153,759	--	310,178
Lake	107,864	--	--	169,060	--	276,924
Malheur	--	--	--	--	--	--
Morrow	26,768	--	--	4,815	--	31,583
Sherman	--	--	--	--	--	--
Umatilla	49,750	93	--	29,853	1,777	81,473
Union	54,407	--	--	50,611	--	105,018
Wallowa	43,760	--	79	59,492	--	103,331
Wasco	22,500	--	1,187	61,525	16,697	101,909
Wheeler	28,383	1,576	65	7,383	--	37,407
Total	583,097	2,650	24,349	1,139,229	96,853	1,846,178
Total Oregon	4,770,279	294,742	1,739,631	3,995,715	96,853	10,897,220

1/ Includes volume removed as logs but not volume for poles, piling, and woodcutting operations.

2/ Compiled by State Forester.

3/ Includes small volume from county and municipal lands.

4/ Based on Timber Sale Summary for BLM.

5/ Compiled by U.S. Forest Service.

6/ Compiled by U.S. Bureau of Indian Affairs.

Table 49.–Log production by ownership and county in the State of Oregon, 1965[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/]	Bureau of Land Management[3/]	National Forest[4/]	Indian[5/]	Other public[2/]	Other Federal[2/]	Total
Western Oregon:								
Benton	69,393	11,621	56,663	6,759	--	--	--	144,436
Clackamas	139,050	604	19,425	313,337	--	--	--	472,416
Clatsop	349,713	37,940	--	--	--	169	--	387,822
Columbia	121,180	2,432	80	--	--	151	--	123,843
Coos	466,103	73,549	166,321	75,558	--	1,728	--	783,259
Curry	260,462	2,237	39,677	116,596	--	1,509	--	420,481
Douglas	856,152	38,158	404,448	637,658	--	--	--	1,936,416
Hood River	17,931	54	--	48,884	--	2,112	--	68,981
Jackson	201,461	2,716	137,148	175,256	--	--	--	516,581
Josephine	15,870	1,097	79,410	69,161	--	1,316	--	166,854
Lane	552,539	25,097	203,346	1,034,640	--	594	2,121	1,818,337
Lincoln	349,718	10,433	10,909	157,514	--	1,690	--	530,264
Linn	482,871	4,158	68,471	284,973	--	--	1,532	842,005
Marion	12,208	7,785	13,796	117,803	--	--	--	151,592
Multnomah	10,258	--	18	42,849	--	--	--	53,125
Polk	62,127	17,215	47,856	4,345	--	--	--	131,543
Tillamook	148,396	52,202	27,677	51,539	--	966	--	280,780
Washington	27,093	2,338	6,223	--	--	--	--	35,654
Yamhill	23,205	--	22,858	724	--	--	--	46,787
Total	4,165,730	289,636	1,304,326	3,137,596	--	10,235	3,653	8,911,176
Eastern Oregon:								
Baker	1,232	--	73	115,346	--	--	--	116,651
Crook	6,977	--	1,849	64,307	--	--	--	73,133
Deschutes	24,460	25	136	115,881	--	--	--	140,502
Gilliam	--	--	--	--	--	--	--	--
Grant	30,675	--	1,299	238,717	--	--	--	270,691
Harney	--	--	536	82,925	--	--	--	83,461
Jefferson	--	--	--	54,142	53,302	--	--	107,444
Klamath	237,650	3,094	8,291	198,164	--	--	--	447,199
Lake	63,597	34	--	121,017	--	--	--	184,648
Malheur	--	--	--	1,284	--	--	--	1,284
Morrow	17,082	--	--	12,091	--	--	--	29,173
Sherman	--	--	--	--	--	--	--	--
Umatilla	65,317	910	--	33,491	280	--	--	99,998
Union	58,524	--	--	73,616	--	--	--	132,140
Wallowa	72,137	--	--	66,233	--	--	--	138,370
Wasco	22,090	8,774	197	57,459	25,457	--	--	113,977
Wheeler	23,254	1,990	--	29,853	--	--	--	55,097
Total	622,995	14,827	12,381	1,264,526	79,039	--	--	1,993,768
Total Oregon	4,788,725	304,463	1,316,707	4,402,122	79,039	10,235	3,653	10,904,944

1/ Includes volume removed as logs, poles, and piling but not volume removed for woodcutting operations.

2/ Compiled by State Forester.

3/ Compiled by U.S. Bureau of Land Management.

4/ Compiled by U.S. Forest Service, Region 6.

5/ Compiled by U.S. Bureau of Indian Affairs.

Table 50.–Log production by ownership and county in the State of Oregon, 1966 [1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private 2/	State 2/	Bureau of Land Management 3/	National Forest 4/	Indian 5/	Other public 2/	Other Federal 2/	Total
Western Oregon:								
Benton	58,992	13,183	56,414	22,812	--	19	—	151,420
Clackamas	149,704	--	34,693	316,355	--	1,569	--	502,321
Clatsop	287,604	28,766	--	--	--	--	--	316,370
Columbia	115,982	1,179	896	--	--	1,460	--	119,517
Coos	459,415	54,259	139,180	84,852	--	954	4,828	743,488
Curry	255,860	706	22,275	146,651	--	2,506	--	427,998
Douglas	816,730	38,010	403,518	476,403	--	--	--	1,734,661
Hood River	47,752	--	--	37,055	--	15,932	--	100,739
Jackson	252,459	--	144,045	140,253	--	--	--	536,757
Josephine	9,587	2,553	79,201	73,627	--	2,954	--	167,922
Lane	650,688	8,153	166,065	837,537	--	139	338	1,662,920
Lincoln	344,058	391	19,159	146,530	--	5,733	—	515,871
Linn	537,978	4,357	82,023	192,758	--	--	1,750	818,866
Marion	16,626	10,985	9,750	67,230	--	--	--	104,591
Multnomah	5,188	--	24	43,452	--	--	--	48,664
Polk	66,205	5,660	43,868	604	--	--	--	116,337
Tillamook	119,405	49,418	29,817	42,486	--	11,177	--	252,303
Washington	28,635	--	4,952	--	--	--	--	33,587
Yamhill	22,484	—	39,726	1,931	--	--	--	64,141
Total	4,245,352	217,620	1,275,606	2,630,536	--	42,443	6,916	8,418,473
Eastern Oregon:								
Baker	375	--	18	122,943	--	--	--	123,336
Crook	3,565	--	3,470	75,114	--	--	--	82,149
Deschutes	43,635	--	111	93,732	--	--	-	137,478
Gilliam	--	--	--	--	--	--	--	--
Grant	51,041	--	7,438	167,241	--	--	--	225,720
Harney	--	--	1,388	75,007	--	--	--	76,395
Jefferson	2,033	--	--	17,548	22,241	--	--	41,822
Klamath	234,088	1,605	27,709	190,888	--	--	--	454,290
Lake	97,070	--	--	179,439	--	-	--	276,509
Malheur	--	--	--	2,675	--	--	--	2,675
Morrow	22,497	--	--	22,791	--	--	--	45,288
Sherman	--	--	--	--	--	--	--	--
Umatilla	70,344	--	3,959	43,763	2,522	--	--	120,588
Union	48,807	--	--	47,187	--	--	--	95,994
Wallowa	48,716	--	48	59,599	--	--	--	108,363
Wasco	10,367	2,140	1,397	59,171	39,695	--	--	112,770
Wheeler	15,988	303	--	9,095	--	--	--	25,386
Total	648,526	4,048	45,538	1,166,193	64,458	--	--	1,928,763
Total Oregon	4,893,878	221,668	1,321,144	3,796,729	64,458	42,443	6,916	10,347,236

1/ Includes volume removed as logs, poles, and piling but not volume removed for woodcutting operations.

2/ Compiled by State Forester.

3/ Compiled by U.S. Bureau of Land Management.

4/ Compiled by U.S. Forest Service, Region 6.

5/ Compiled by U.S. Bureau of Indian Affairs.

Table 51.–Log production by ownership and county in the State of Oregon, 1967[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/]	Bureau of Land Management[3/]	National Forest[4/]	Indian[5/]	Other public[2/]	Other Federal[2/]	Total
Western Oregon:								
Benton	40,606	4,566	53,322	20,157	--	--	--	118,651
Clackamas	128,453	604	26,105	274,472	--	--	--	429,634
Clatsop	259,830	33,853	--	--	--	830	--	294,513
Columbia	112,393	4,798	97	--	--	935	--	118,223
Coos	357,102	31,459	92,039	86,663	--	1,306	--	568,569
Curry	259,451	286	20,874	173,084	--	606	--	454,301
Douglas	858,191	30,607	426,986	402,052	--	181	--	1,718,017
Hood River	8,594	330	--	38,262	--	4,817	--	52,003
Jackson	186,116	--	102,526	217,501	--	--	--	506,143
Josephine	8,224	30	95,629	71,334	--	2,371	--	177,588
Lane	741,879	4,810	120,887	690,525	--	450	--	1,558,551
Lincoln	331,672	279	10,470	160,893	--	513	--	503,827
Linn	508,091	1,890	56,010	195,655	--	--	--	761,646
Marion	19,877	2,845	9,162	51,418	--	--	--	83,302
Multnomah	2,403	--	--	24,502	--	--	--	26,905
Polk	44,356	1,873	20,828	6,518	--	--	--	73,575
Tillamook	148,138	33,640	61,823	51,539	--	2,080	--	297,220
Washington	16,944	83	3,197	--	--	--	--	20,224
Yamhill	28,589	--	31,241	6,035	--	3,250	--	69,115
Total	4,060,909	151,953	1,131,196	2,470,610	--	17,339	--	7,832,007
Eastern Oregon:								
Baker	2,939	--	470	99,510	--	--	--	102,919
Crook	11,768	--	--	87,526	--	--	--	99,294
Deschutes	52,402	--	1,405	96,728	--	--	--	150,535
Gilliam	--	--	--	--	--	--	--	--
Grant	78,218	--	9,275	191,316	--	--	--	278,809
Harney	214	--	1,960	74,365	--	--	--	76,539
Jefferson	7,604	--	--	28,355	18,010	--	--	53,969
Klamath	134,086	11	10,978	154,936	--	--	--	300,011
Lake	36,682	--	2	218,494	--	--	--	255,178
Malheur	161	--	--	--	--	--	--	161
Morrow	29,036	193	--	10,486	--	--	--	39,715
Sherman	--	--	--	--	--	--	--	--
Umatilla	19,928	--	199	48,150	263	--	--	68,540
Union	56,471	--	4,660	58,529	--	--	--	119,660
Wallowa	59,837	--	274	81,534	--	--	--	141,645
Wasco	257	--	--	57,887	99,116	--	--	157,260
Wheeler	11,598	1,251	--	5,457	--	--	--	18,306
Total	501,201	1,455	29,223	1,213,273	117,389	--	--	1,862,541
Total Oregon	4,562,110	153,408	1,160,419	3,683,883	117,389	17,339	--	9,694,548

1/ Includes volume removed as logs, poles, and piling but not volume removed for woodcutting operations.

2/ Compiled by State Forester.

3/ Compiled by U.S. Bureau of Land Management.

4/ Compiled by U.S. Forest Service, Region 6.

5/ Compiled by U.S. Bureau of Indian Affairs.

Table 52.–Log production by ownership and county in the State of Oregon, 1968[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/]	Bureau of Land Management[3/]	National Forest[4/]	Indian[5/]	Other public[2/]	Other Federal[2/]	Total
Western Oregon:								
Benton	40,541	2,913	50,063	22,422	--	--	--	115,939
Clackamas	170,144	--	52,135	281,693	--	--	3,879	507,851
Clatsop	413,932	45,538	--	--	--	45	--	459,515
Columbia	129,028	894	1,015	--	--	817	--	131,754
Coos	254,089	19,238	142,045	24,228	--	242	--	439,842
Curry	238,438	104	41,185	195,438	--	3,814	--	478,979
Douglas	980,415	22,339	586,688	571,189	--	76	--	2,160,707
Hood River	14,750	--	--	26,729	--	2,444	--	43,923
Jackson	288,329	4,138	140,887	213,372	--	--	--	646,726
Josephine	14,469	724	83,561	68,859	--	1,208	--	168,821
Lane	789,761	8,177	185,314	901,105	--	66	604	1,885,027
Lincoln	363,302	5,788	22,124	152,713	--	--	--	543,927
Linn	511,957	4,349	73,017	248,125	--	--	42	837,490
Marion	34,345	13,081	4,278	117,419	--	--	1,132	170,255
Multnomah	4,529	--	--	79,223	--	--	--	83,752
Polk	75,917	2,427	34,630	1,114	--	--	--	114,088
Tillamook	136,059	61,543	56,081	56,913	--	217	--	310,813
Washington	30,368	--	2,183	--	--	5,070	--	37,621
Yamhill	18,566	--	44,727	7,560	--	--	--	70,853
Total	4,508,939	191,253	1,519,933	2,968,102	--	13,999	5,657	9,207,883
Eastern Oregon:								
Baker	5,002	--	3,120	110,260	--	--	--	118,382
Crook	11,279	342	--	90,620	--	--	--	102,241
Deschutes	9,553	--	2,703	61,880	--	--	--	74,136
Gilliam	428	--	--	--	--	--	--	428
Grant	19,013	--	5,722	228,802	--	--	--	253,537
Harney	3,403	--	618	64,228	--	--	--	68,249
Jefferson	11,048	--	55	51,430	49,020	--	--	111,553
Klamath	180,161	2,728	21,668	221,828	--	--	--	426,385
Lake	263,817	--	--	160,043	--	--	--	423,860
Malheur	--	--	122	3	--	--	--	125
Morrow	22,229	--	--	2,631	--	--	--	24,860
Sherman	--	--	--	--	--	--	--	--
Umatilla	23,265	--	155	54,211	748	--	--	78,379
Union	31,674	--	1,039	53,502	--	--	--	86,215
Wallowa	56,526	--	2,349	105,771	--	--	--	164,646
Wasco	4,500	--	1,248	30,358	56,984	--	--	93,090
Wheeler	19,166	--	3,260	29,759	--	--	--	52,185
Total	661,064	3,070	42,059	1,265,326	106,752	--	--	2,078,271
Total Oregon	5,170,003	194,323	1,561,992	4,233,428	106,752	13,999	5,657	11,286,154

1/ Includes volume removed as logs, poles, and piling but not volume removed for woodcutting operations.

2/ Compiled by State Forester.

3/ Compiled by U.S. Bureau of Land Management.

4/ Compiled by U.S. Forest Service, Region 6.

5/ Compiled by U.S. Bureau of Indian Affairs.

Table 53.–Log production by ownership and county in the State of Oregon, 1969[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2/]	State[2/]	Bureau of Land Management[3/]	National Forest[4/]	Indian[5/]	Other public[2/]	Other Federal[2/]	Total
Western Oregon:								
Benton	45,065	15,661	44,644	6,291	--	--	--	111,661
Clackamas	183,320	814	35,960	327,952	--	8,087	--	556,133
Clatsop	303,494	29,552	--	--	--	1,759	--	334,805
Columbia	120,272	547	--	--	--	--	--	120,819
Coos	208,729	49,249	144,193	27,838	--	845	--	430,854
Curry	314,399	--	27,975	143,410	--	--	--	485,784
Douglas	1,040,916	41,911	381,334	500,501	--	941	--	1,965,603
Hood River	4,547	--	--	35,621	--	2,467	--	42,635
Jackson	271,387	--	118,699	139,936	--	--	--	530,022
Josephine	22,054	5,025	72,642	60,560	--	2,590	--	162,871
Lane	587,442	2,716	226,413	903,263	--	483	--	1,720,317
Lincoln	266,175	11,372	16,040	121,979	--	163	48	415,777
Linn	448,770	1,477	91,510	252,430	--	--	--	794,187
Marion	38,024	6,080	8,921	88,221	--	5	--	141,251
Multnomah	1,347	--	--	41,944	--	8,449	--	51,740
Polk	82,399	5,646	27,880	--	--	--	--	115,925
Tillamook	173,818	59,501	22,208	41,728	--	1,002	--	298,257
Washington	47,176	748	637	--	--	--	--	48,561
Yamhill	23,679	--	33,967	4,052	--	1,328	--	63,026
Total	4,183,013	230,299	1,253,023	2,695,726	--	28,119	48	8,390,228
Eastern Oregon:								
Baker	11,520	--	858	97,374	--	--	--	109,752
Crook	10,389	--	--	80,247	--	--	--	90,636
Deschutes	12,530	--	541	84,868	--	1	--	97,940
Gilliam	2,632	--	--	--	--	--	--	2,632
Grant	52,400	--	4,795	203,366	--	--	--	260,561
Harney	4,312	--	3,788	58,388	--	--	--	66,488
Jefferson	39,281	--	--	53,446	43,557	--	--	136,284
Klamath	280,035	8,438	16,587	211,445	--	--	--	516,505
Lake	205,318	--	3	139,095	--	--	--	344,416
Malheur	--	--	379	--	--	--	--	379
Morrow	9,564	--	--	1,005	--	--	--	10,569
Sherman	--	--	--	--	--	--	--	--
Umatilla	40,481	--	--	56,696	28	--	--	97,205
Union	28,841	931	873	80,308	--	--	--	110,953
Wallowa	36,903	--	345	138,975	--	--	--	176,223
Wasco	4,367	--	--	78,177	54,750	--	--	137,294
Wheeler	10,021	--	--	33,680	--	--	--	43,701
Total	748,594	9,369	28,169	1,317,070	98,335	1	--	2,201,538
Total Oregon	4,931,607	239,668	1,281,192	4,012,796	98,335	28,120	48	10,591,766

1/ Includes volume removed as logs, poles, and piling, but not volume removed for woodcutting operations.

2/ Compiled by State Forester.

3/ Compiled by U.S. Bureau of Land Management.

4/ Compiled by U.S. Forest Service, Region 6.

5/ Compiled by U.S. Bureau of Indian Affairs.

Table 54.–Log production by ownership and county in the State of Oregon, 1970[1]

(Thousand board feet, International 1/4-inch scale)

State and county	Private[2]	State[2]	Bureau of Land Management[3]	National Forest[4]	Indian[5]	Other public[2]	Other Federal[2]	Total
Western Oregon:								
Benton	63,137	10,578	52,838	34,336	--	--	--	160,889
Clackamas	139,154	--	33,346	219,637	--	--	--	392,137
Clatsop	339,838	26,183	--	--	--	--	--	366,021
Columbia	115,020	634	189	--	--	--	--	115,843
Coos	405,110	45,252	159,081	30,886	--	1,360	--	641,689
Curry	182,757	3,596	23,779	120,123	--	1,177	--	331,432
Douglas	838,406	21,861	361,356	407,125	--	1,347	--	1,630,095
Hood River	9,208	--	--	33,762	--	1,497	--	44,467
Jackson	195,491	--	70,567	102,383	--	--	1,569	370,010
Josephine	12,164	--	49,365	73,666	--	4,331	--	139,526
Lane	719,021	6,333	138,437	668,251	--	--	--	1,532,042
Lincoln	187,390	10,692	15,415	57,902	--	--	--	271,399
Linn	400,029	1,537	50,448	259,833	--	--	--	711,847
Marion	27,841	9,661	12,822	90,278	--	--	--	140,602
Multnomah	1,654	--	--	62,198	--	--	--	63,852
Polk	58,816	541	41,244	--	--	--	--	100,601
Tillamook	142,444	38,138	43,823	26,672	--	36	--	251,113
Washington	21,936	2,729	--	--	--	--	--	24,665
Yamhill	17,932	--	23,977	2,512	--	181	--	44,602
Total	3,877,348	177,735	1,076,687	2,189,564	--	9,929	1,569	7,332,832
Eastern Oregon:								
Baker	4,287	--	1,187	65,676	--	--	--	71,150
Crook	14,230	--	9,273	85,637	--	--	--	109,140
Deschutes	26,129	--	--	73,321	--	--	--	99,450
Gilliam	--	--	--	--	--	--	--	--
Grant	46,604	--	4,472	199,980	--	--	--	251,056
Harney	3,940	--	140	60,334	--	--	--	64,414
Jefferson	41,370	--	--	35,113	33,089	--	--	109,572
Klamath	245,189	799	7,134	207,201	--	--	--	460,323
Lake	176,886	--	--	100,559	--	--	--	277,445
Malheur	--	--	--	4	--	--	--	4
Morrow	17,426	--	1,105	11,933	--	--	--	30,464
Sherman	--	--	--	--	--	--	--	--
Umatilla	27,685	--	269	19,397	891	--	--	48,242
Union	58,244	1,766	108	79,282	--	--	--	139,400
Wallowa	38,420	--	92	60,604	--	--	--	99,116
Wasco	5,001	--	1,087	54,533	50,032	--	--	110,653
Wheeler	3,029	--	56	35,433	--	--	--	38,518
Total	708,440	2,565	24,923	1,089,007	84,012	--	--	1,908,947
otal Oregon	4,585,788	180,300	1,101,610	3,278,571	84,012	9,929	1,569	9,241,779

1/ Includes volume removed as logs, poles, and piling, but not volume removed for woodcutting operations.

2/ Compiled by State Forester.

3/ Compiled by U.S. Bureau of Land Management.

4/ Compiled by U.S. Forest Service, Region 6.

5/ Compiled by U.S. Bureau of Indian Affairs.

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Wall, Brian R.
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The mission of the PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION is to provide the knowledge, technology, and alternatives for present and future protection, management, and use of forest, range, and related environments.

Within this overall mission, the Station conducts and stimulates research to facilitate and to accelerate progress toward the following goals:

1. Providing safe and efficient technology for inventory, protection, and use of resources.
2. Development and evaluation of alternative methods and levels of resource management.
3. Achievement of optimum sustained resource productivity consistent with maintaining a high quality forest environment.

The area of research encompasses Oregon, Washington, Alaska, and, in some cases, California, Hawaii, the Western States, and the Nation. Results of the research will be made available promptly. Project headquarters are at:

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Bend, Oregon
Corvallis, Oregon
La Grande, Oregon
Portland, Oregon
Olympia, Washington
Seattle, Washington
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The FOREST SERVICE of the U.S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.

USDA Forest Service
Resource Bulletin PNW-43

July 1972
Revised Aug. 1972

1971 OREGON TIMBER HARVEST

by

Brian R. Wall, *Associate Economist*

The 1971 Oregon timber harvest of 9.03 billion board feet was the highest since 1969 when 9.15 billion board feet was harvested. The 1971 total harvest was 13.1 percent above the 1970 figure. Western Oregon's harvest rose 11.5 percent, and eastern Oregon's harvest rose 18.6 percent.

The total private timberland harvest for 1971 was 4.23 billion board feet--the highest level since 1968. Of this, harvest on forest industry lands increased 172 million board feet (up 4.9 percent), and nonindustrial "other private" land's production increased by 183 million board feet (up 47.9 percent).

Log harvest on public lands increased 691 million board feet to 4.80 billion board feet in 1971. National Forests' harvest increased 365 million board feet (up 12.9 percent), and the Bureau of Land Management increased production by 303 million board feet (up 29.2 percent). The timber harvest on Indian lands increased 8.6 million board feet, and on State lands it increased 7.9 million board feet.

Public stumpage prices rose during 1971 with the average for western Oregon 12.4 percent above that recorded in 1970. However, eastern Oregon's average public stumpage price was 4.1 percent below the 1970 level. Even though the volume of public stumpage sold dropped 14.2 percent in 1971, this sales volume was greater than the timber harvest. As a result, the volume of uncut public timber under contract in Oregon rose 3.1 percent to 10.5 billion board feet.

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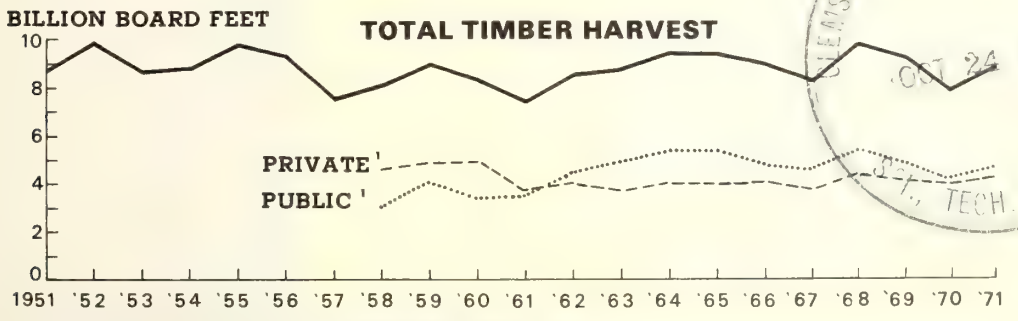

OREGON TIMBER HARVEST, 1951–71

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION

Robert E. Buckman, Director
FOREST SERVICE

Portland, Oregon
U.S. Department of Agriculture

Timber harvest by ownership in the State of Oregon, 1971 [1/]

(In thousands of board feet, Scribner log scale)

State and county	Private [2/]			Bureau of Land Management [3/]	National Forest [4/]	Indian [5/]	Other Federal [2/]	State [2/]	Other public [2/]	Total
	Forest industry	Other	Total							
Western Oregon:										
Benton	37,948	27,814	65,762	59,303	13,390	--	--	3,261	--	141,716
Clackamas	96,643	7,817	104,460	32,712	199,206	--	--	1,760	735	338,873
Clatsop	350,671	5,190	355,861	--	--	--	--	24,965	--	380,826
Columbia	50,158	16,328	66,486	750	5	--	--	488	2,930	70,659
Coos	406,379	10,645	417,024	161,997	42,682	--	--	23,352	3,321	648,376
Curry	57,158	10,222	67,380	47,909	148,351	--	--	8,919	800	273,359
Douglas	695,322	28,356	723,678	459,826	389,391	--	--	29,540	341	1,602,776
Hood River	5,302	518	5,820	--	39,168	--	--	1,816	5,531	52,335
Jackson	159,490	4,801	164,291	119,250	144,946	--	--	257	--	428,744
Josephine	1,862	3,732	5,594	50,625	44,560	--	--	2,200	2,145	105,124
Lane	623,261	30,784	654,045	153,811	653,504	--	--	4,471	5	1,465,836
Lincoln	128,418	9,648	138,066	14,542	80,320	--	--	7,036	--	239,964
Linn	214,991	86,519	301,510	82,304	213,463	--	--	1,870	--	599,147
Marion	24,539	4,524	29,063	11,657	43,370	--	--	2,106	--	86,196
Multnomah	--	360	360	56	14,270	--	--	--	624	15,310
Polk	47,982	14,325	62,307	35,297	--	--	--	9,772	--	107,376
Tillamook	179,172	3,947	183,119	31,044	19,849	--	--	32,224	--	266,236
Washington	13,321	8,175	21,496	946	--	--	--	625	--	23,067
Yamhill	13,026	6,999	20,025	42,333	2,974	--	--	--	--	65,332
Total	3,105,643	280,704	3,386,347	1,304,362	2,049,449	--	--	154,662	16,432	6,911,252
Eastern Oregon:										
Baker	567	53,142	53,709	35	83,208	--	--	--	--	136,952
Crook	1,941	98	2,039	4,118	76,454	--	--	--	--	82,611
Deschutes	1,955	--	1,955	--	55,380	--	--	--	--	57,335
Gilliam	--	323	323	--	--	--	--	--	--	323
Grant	29,772	10,130	39,902	5,997	229,562	--	--	2,515	--	277,976
Harney	--	--	--	54	83,615	--	--	--	--	83,669
Jefferson	2,957	3,495	6,452	--	46,358	31,525	--	--	--	84,335
Klamath	292,793	92,280	385,073	19,384	205,640	--	--	--	--	610,097
Lake	160,014	92,465	252,479	248	100,660	--	--	--	--	353,387
Malheur	--	--	--	--	--	--	--	--	--	--
Morrow	13,671	1,570	15,241	--	913	--	--	--	--	16,154
Sherman	--	--	--	--	--	--	--	--	--	--
Umatilla	4,796	14,482	19,278	--	24,911	252	--	--	--	44,441
Union	27,276	5,633	32,909	5,748	78,200	--	--	--	--	116,857
Wallowa	7,797	5,946	13,743	161	66,887	--	--	--	--	80,791
Wasco	--	3,200	3,200	23	69,937	55,309	--	360	--	128,829
Wheeler	13,924	3,388	17,312	--	25,350	--	--	--	--	42,662
Total	557,463	286,152	843,615	35,768	1,147,075	87,086	--	2,875	--	2,116,417
Total Oregon	3,663,106	566,856	4,229,962	1,340,130	3,196,524	87,086	--	157,537	16,432	9,027,669

1/ Includes volume removed as logs and poles and piling, but not volume removed for woodcutting operations.
2/ Compiled by State Forester.
3/ Compiled by U.S. Bureau of Land Management.
4/ Compiled by U.S. Forest Service, Region 6.
5/ Compiled by U.S. Bureau of Indian Affairs.

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Keywords: Timber statistics, Oregon.

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logging residue

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volume and characteristics

JAMES O. HOWARD

NORTHWEST
AND RANGE EXPERIMENT STATION
RTMENT OF AGRICULTURE
ERVICE PORTLAND, OREGON

ABSTRACT

This report makes available data on the volume and characteristics of logging residue resulting from 1969 logging operations in Oregon, Washington, and California.

The results indicate highest volumes of logging residue are found in the Douglas-fir region of western Oregon and western Washington. Average gross volume of residue in this region ranged from 4,548 cubic feet per acre on National Forest land to 1,491 cubic feet per acre on private land; net volume averaged 3,127 and 1,328 cubic feet per acre, respectively. Total net volume for all owners in this region was estimated to be about 460 million cubic feet for 1969. The lowest average volume of logging residue was found in the ponderosa pine region of eastern Oregon and eastern Washington--gross averaged between 350 and 400 cubic feet per acre for all owners. In California, gross volume averaged 1,905 cubic feet per acre for private lands and 1,460 cubic feet per acre for National Forests.

Additional information is provided concerning the average and total volume of residue by diameter class, length class, soundness, and type of material.

KEYWORDS: Slash, logging, wood waste, Oregon, Washington, California.

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INTRODUCTION

Large quantities of wood residue are a byproduct of logging activities. Traditionally, these logging residues have been considered a fire hazard, an impediment to reforestation and young-growth management, and an eyesore. Their disposal has been economically and environmentally costly. In recent years, interest has been shown in the potential of logging residues with the objective of extending the Nation's wood supply and solving, at least in part, the disposal problems.

Whether one is interested in fire hazard reduction, disposal costs, or utilization possibilities, information is needed on the amount and characteristics of the residue. In general, lack of this type of data has hampered intensive probes into the crucial problems associated with the use or disposal of logging residues.

This report makes available regional data on the volume and characteristics of logging residues resulting from 1969 logging operations. The study was conducted on clearcut operations in western Oregon and western Washington,[1] and all types of logging operations in eastern Oregon and eastern Washington,[2] and California. Because of the uniqueness of these three regions, they were sampled separately and are discussed separately.

In general, logging residue is defined as all material left on or near the ground after a logging operation. In this report, logging residue[3] is that portion of the material that is at least 4 inches in diameter and 4 feet in length excluding stumps and old, punky logs that are rotten to the point of losing their cylindrical form. Throughout the text, reference to net and gross volume excludes limbwood, which is reported in tables 14 and 15.

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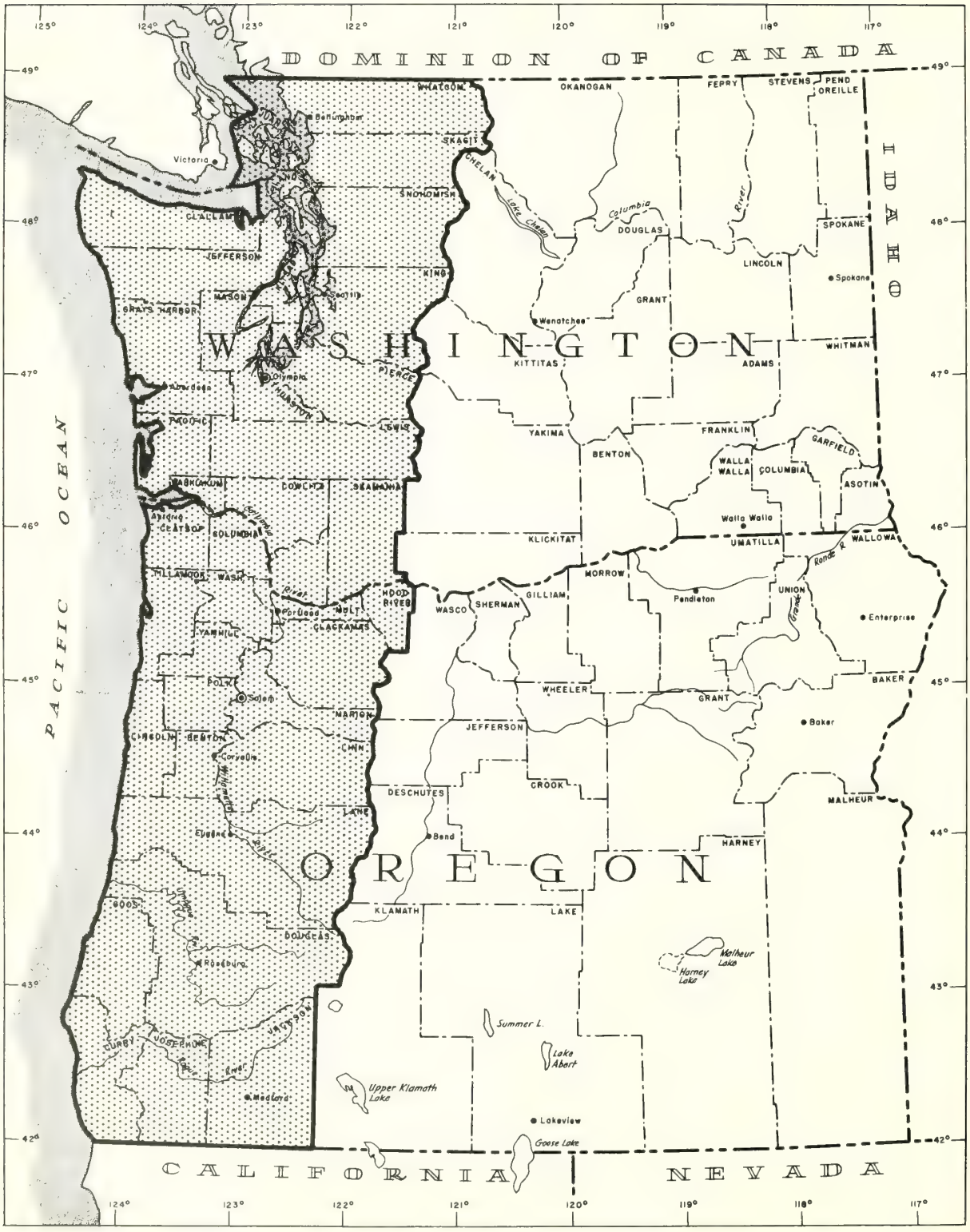
[1] *Hereafter referred to as the Douglas-fir region.*

[2] *Hereafter referred to as the ponderosa pine region.*

[3] *Technical terms used in this text are listed in "Definitions."*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Eugene
Roseburg
Medford
Bend
Pendleton
Walla Walla
Baker
Enterprise
Wenatchee
Spokane
Lakeview
Goose Lake
Upper Klamath Lake
Summer L.
Lake Abert
Malheur Lake
Harney Lake
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DOUGLAS-FIR REGION

VOLUME PER ACRE WAS HIGHEST ON NATIONAL FOREST LANDS

Of the three areas included in this 1969 study, the highest average volumes of logging residue were found on Douglas-fir region clearcuts. Within this region, the highest average net volume, 3,127 cubic feet per acre, occurred on National Forest lands. Private lands have the lowest average net volume, with only 1,328 cubic feet per acre. The average net volume for other public ownerships is 2,025 cubic feet per acre.

Although many factors contribute to the higher volumes of residue on National Forest land, two of the more important are: (1) A higher proportion of the log harvest on the National Forests comes from old-growth timber with higher proportion of defect, which yields more residue per acre than young-growth timber. Data from this study indicate the average age of the stands clearcut on the National Forest samples was 260 years. The average age of the samples on private lands was only 140 years. (2) Private companies operating on their own lands receive all benefits from residue reduction efforts, such as hazard reduction, site preparation, and increased mobility for second-growth management. These benefits accrue to these submarginal logs, thus making their removal economically more feasible. However, on public lands the operator receives only the product conversion value of the timber, thereby resulting in a larger marginal log and a a greater volume of residue.

RESIDUE ON PUBLIC LANDS WAS LARGER THAN ON PRIVATE LANDS

The residue measured on public lands in 1969 averaged larger than on private lands. Shown below is average net volume for two classifications:

	Percent of net volume 28 inches in diameter and larger	Percent of net volume 20 feet in length and longer
Public	32	40
Private	20	26

The primary factor contributing to the greater proportion of larger material on public lands is the higher average age of the timber. It is this larger diameter material, associated with old-growth stands, that presents the greatest problems of mobility related to intensive management.

In terms of residue material greater than 28 inches in diameter *and* 20 feet in length, the public lands have a substantially greater volume. Residue in this category averages 527 and 316 cubic feet per acre net volume on the National Forests and other public lands, respectively. These higher average volumes represent a greater opportunity for utilization than the 20 cubic feet per acre on private lands.

LARGER SHARE OF RESIDUE ON PUBLIC LANDS CAME FROM DEAD TREES

The net volume of residue at the time of logging in 1969 attributable to dead trees or logs was estimated at 630 cubic feet per acre on public lands. On private lands, this type of residue accounts for only 36 cubic feet per acre. These figures do not represent the total contribution of dead trees, since some of the preharvest dead material may be removed during logging operations. Thus these

figures underestimate the volume of dead material prior to logging.

OLDER STANDS YIELDED MORE RESIDUE WITH LESS SOUND WOOD

As indicated by the following tabulation, the greater volumes of logging residue are associated with a higher average stand age. Also, the residue that is created, or already existing, contains a higher proportion of cull, or rotten, wood.

Age of stand harvested (years)	Average gross volume (cubic feet per acre)	Average defect of residue (percent)
<101	1,236	12
101-200	1,948	18
201-300	3,915	26
301+	5,812	31

The high degree of rot associated with old-growth stands is clearly indicated by these data.

HIGHEST VOLUMES IN THE PRIVATE SECTOR WERE FROM CEDAR STANDS

The net volume of residue on two sample units in privately owned cedar stands averaged 3,400 cubic feet per acre in 1969. This was over 2.5 times greater than the average for the private sector as a whole. The characteristics of the residue on these cedar stands differed substantially from that found on the other forest types. For example, in the private sector the net volume of residue greater than 36 inches in diameter was 175 cubic feet per acre. This same size class of residue on the two cedar tracts averaged 668 cubic feet per acre. Likewise, the net volume of slabs and splinters for the entire sector was 162 cubic feet per acre, but for the cedar tracts alone the average was 663 cubic feet per acre. Excluding the two cedar sample units from the private sector would have the effect of reducing the average net volume of logging residue 14 percent, to 1,148 cubic feet per acre.

There are three major factors which help explain the greater volume of residue associated with harvesting of cedar stands. They are: (1) the general decadent condition of the old-growth stands, where dead and cull trees are prevalent, (2) the tendency of cedar to split or shatter during the felling operation, and (3) the poor market for low quality logs, due particularly to the lack of demand for cedar chips.

VOLUME OF UTILITY LOGS WAS HIGHEST ON NATIONAL FOREST CLEARCUTS

Utility logs, commonly called chip logs, represent the lowest log grade currently recognized. As economic conditions change, it will be this type of log that will present the best opportunities for increasing utilization. For the National Forest sample in 1969, about 1,795 cubic feet per acre, 57 percent of the net volume, was utility log material. For other public and private sectors, 56 and 47 percent of the average net volume, respectively, met the definition for a utility log. Improved markets for chips and lower grade lumber, together with improved handling systems, would result in increased utilization of this material with a subsequent reduction of residue disposal problems.

TOTAL NET VOLUME OF RESIDUE FROM CLEARCUTS AMOUNTED TO 460 MILLION CUBIC FEET

The total net volume of logging residue on Douglas-fir region clearcuts was estimated at 460 million cubic feet for 1969. This is about 79 percent of the total gross volume of logging residue. The total net figure is equivalent to about 50 percent of the raw material consumption of Oregon's and Washington's pulp and board industries.[4/]

This residue volume represents the amount created by 1969 clearcut operations; of course, this volume eventually decreases due to slash burning, relogging, and decay. Consequently, the current volume of 1969 residue will be appreciably smaller, reducing both the disposal problem and the raw material potential. It must be kept in mind that, for the most part, this material had a negative market value at the time of logging. Only as technology and economic conditions change or new timber sale policies are formulated will this residue find its way to the marketplace.

4/ *John A. Bergvall and Donald R. Gedney. Washington mill survey, wood consumption and mill characteristics, 1968. State Wash. Dep. Nat. Resour. and Pac. Northwest Forest & Range Exp. Stn., 119 p., illus., 1970.*

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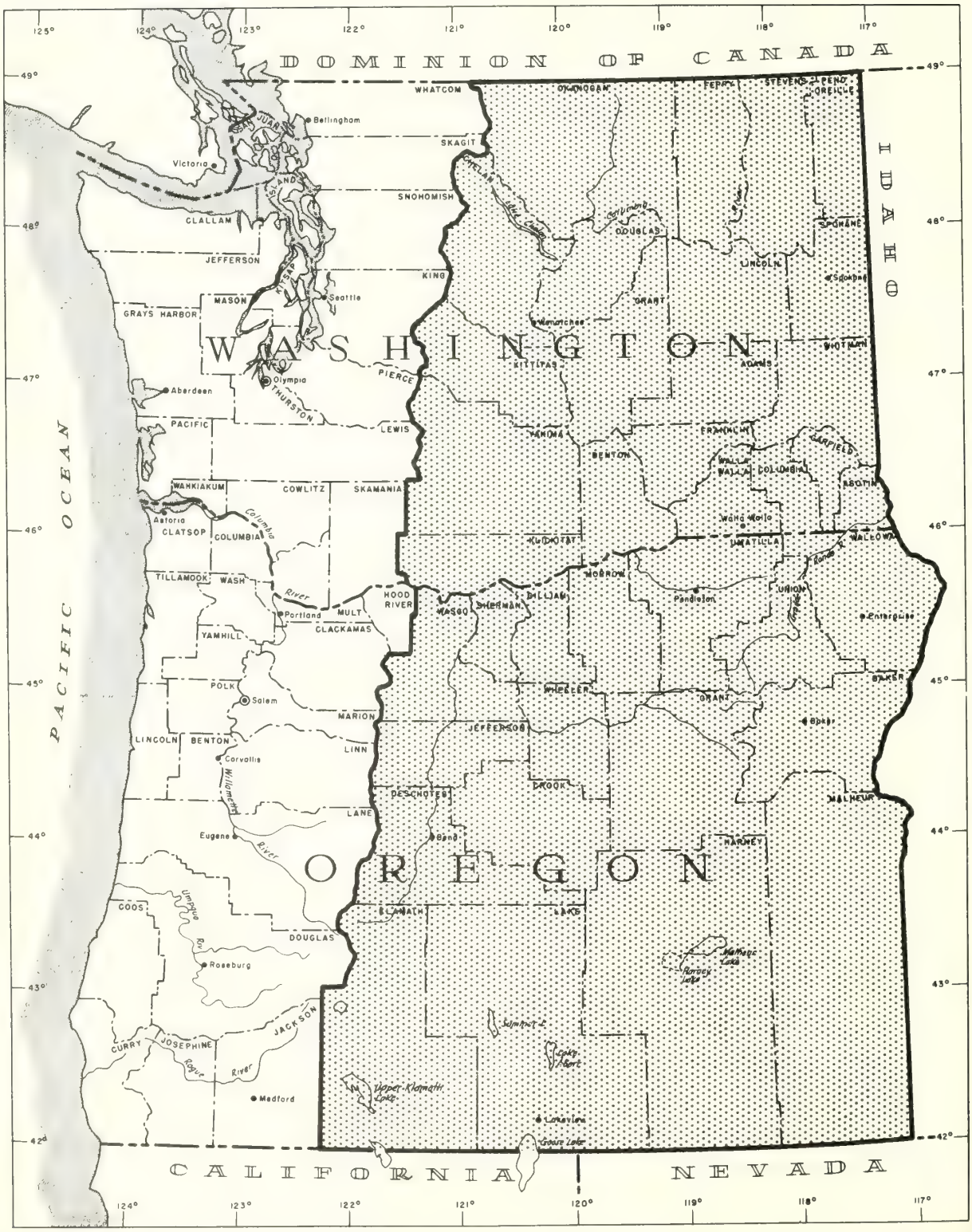
PONDEROSA PINE REGION



PONDEROSA PINE REGION

LOWEST AVERAGE VOLUMES OCCURRED IN THE PONDEROSA PINE REGION

The average per-acre volume of residue in the ponderosa pine region was the lowest of the three regions of the 1969 study. Private lands with 396 and 352 cubic feet per acre, gross and net, averaged only slightly higher than the 356 and 291 cubic feet per acre on the National Forests. These volumes are not surprising in light of the low per-acre harvest volumes and the partial cut harvesting methods used.

FULL TREES OR TOPS CONSTITUTED OVER ONE-HALF OF THE NET VOLUME

As the 1969 data in table 15 show, 48 million cubic feet or 56 percent of the total net volume of residue in the ponderosa pine region was in the form of full trees or tops. This proportion far exceeds that of the other regions. This material consisted primarily of poletimber-size trees that were cut during harvesting operations to decrease competition for better trees and limby tops of older trees. Limby tops are quite common in overmature pine stands.

RESIDUE WAS SMALLER THAN IN THE DOUGLAS-FIR REGION

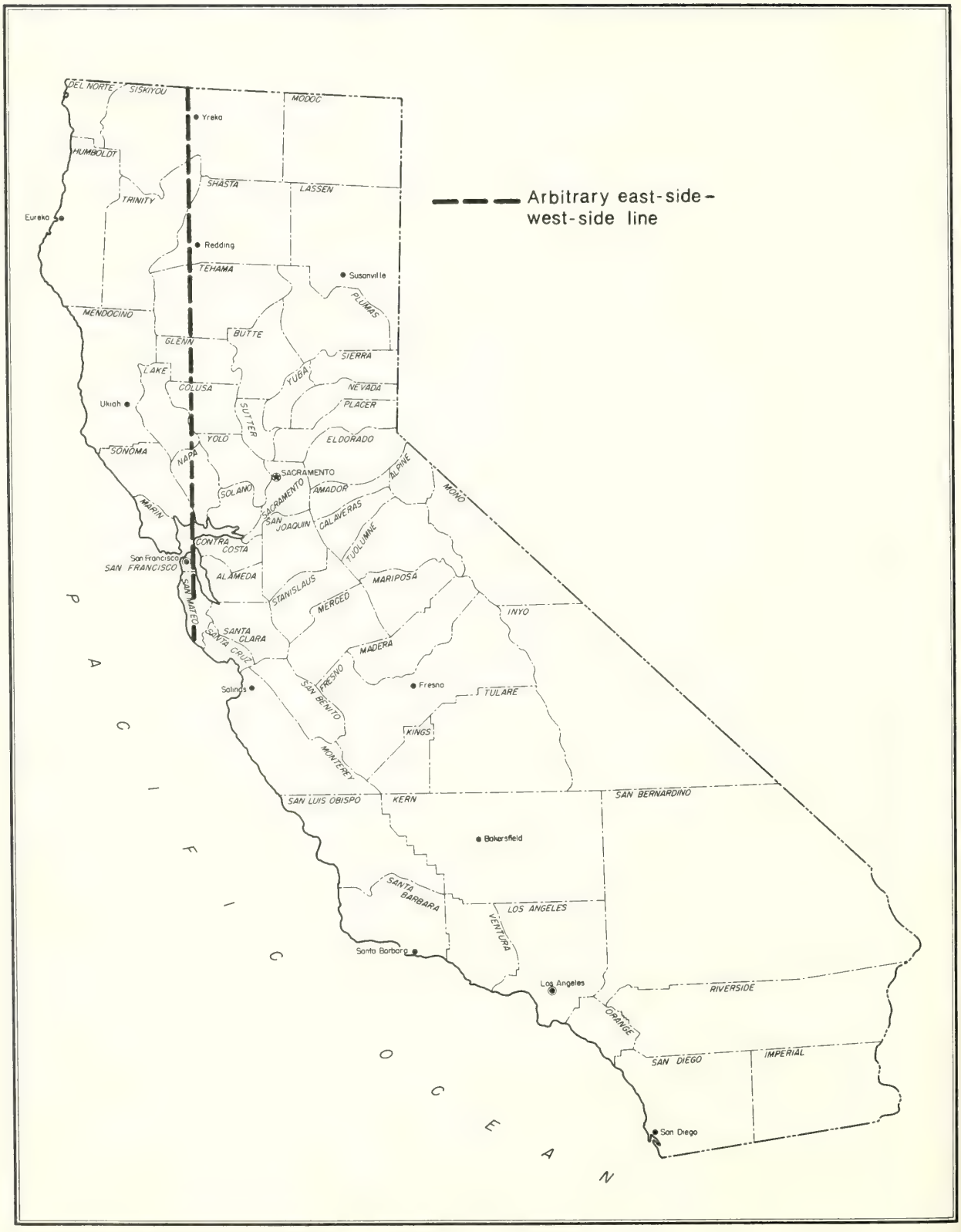
Data from this 1969 study indicate that about 56 percent of the net volume was comprised of pieces less than 12 inches in diameter. This compares with only 33 percent for the Douglas-fir region. Only 14 percent of the residue exceeded 28 inches in diameter in this region, but in the Douglas-fir region 24 percent was greater than 28 inches. Three factors play an important part in creating this high proportion of smaller size residue. These are: (1) smaller average diameter of trees in this region, (2) a generally poor market for small logs, although this has been changing somewhat in the past few years with the installation of chipping saws by a few mills in the area, and (3) cutting of small, nonsalable suppressed trees to reduce competition in the remaining stand.

TOTAL NET VOLUME OF RESIDUE WAS LESS THAN 87 MILLION CUBIC FEET

The total net volume of residue from 1969 logging in the ponderosa pine region was estimated to be about 87 million cubic feet. This was less than one-fifth the total for the Douglas-fir region but was dispersed over a land area almost twice as large. Gross volume in this area was 103.6 million cubic feet.

With the low per-acre volumes, wide geographic dispersion, and poor chip markets, little opportunity exists for relogging in this region. Recent interest in small-log processing equipment should increase utilization and help reduce residue problems for some areas. The highest volumes of residue occur along the Cascades in the transitional timber types. This area, closest to the chip market of western Oregon, should show the greatest change in utilization in the future.

CALIFORNIA


Arbitrary east-side-west-side line
DEL NORTE
SISKIYOU
MODOC
Yreka
HUMBOLDT
SHASTA
LASSEN
TRINITY
Eureka
Redding
TEHAMA
Susanville
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
LAKE
YUBA
COLUSA
NEVADA
Ukiah
SUTTER
PLACER
YOLO
EL DORADO
SONOMA
NAPA
SACRAMENTO
ALPINE
SOLANO
AMADOR
MONO
MARIN
SACRAMENTO
SAN JOAQUIN
CALAVERAS
CONTRA COSTA
TUOLUMNE
San Francisco
SAN FRANCISCO
ALAMEDA
STANISLAUS
MARIPOSA
SAN MATEO
MERCED
INYO
SANTA CLARA
SANTA CRUZ
MADERA
Salinas
SAN BENITO
FRESNO
Fresno
TULARE
KINGS
MONTEREY
SAN LUIS OBISPO
KERN
SAN BERNARDINO
Bakersfield
SANTA BARBARA
LOS ANGELES
VENTURA
Santa Barbara
Los Angeles
RIVERSIDE
ORANGE
SAN DIEGO
IMPERIAL
San Diego
PACIFIC OCEAN

CALIFORNIA

Due to the relatively small sample, geographic stratification within ownership classes was not feasible from a statistical standpoint. Thus, the volume estimates by owner groups for California reflect both the high volume stands along the coast and the low volume interior stands and are not comparable to the same owner groups in the other areas. Data from this 1969 study indicate subsequent studies of residue should be designed for sampling by both geographic area and ownership class.

LOGGING IN EAST-SIDE TYPES RESULTS IN LOWER PER-ACRE RESIDUE VOLUMES

An arbitrary poststratification of the 1969 sample units into east-side and west-side conditions indicated a substantial difference in residue development between the two areas. The sample units in the west side, or coastal area, averaged about 2,755 cubic feet per acre net volume. The east-side, or interior, units averaged only 400 cubic feet per acre. Those results are not surprising in light of the differences between the pine-fir stands of the east side and the redwood-Douglas-fir stands of the west side and the different harvesting systems used.

PRIVATE LANDS HAVE A GREATER VOLUME OF RESIDUE THAN THE NATIONAL FORESTS

The average net volume of residue on private lands was 1,370 cubic feet per acre in 1969, but the National Forests averaged 1,168 cubic feet per acre. The geographic pattern of ownership helps explain this situation. Over 50 percent of the State's timber harvest comes from the heavily forested coastal area, where a much larger proportion of the land is in private ownership compared with National Forest ownership. Thus, the random selection of sample units on the basis of volume harvested has the effect of weighting the private sector toward the coastal area. Also, most of the coastal redwood is in private ownership. These two factors combined would lead to the expectation of more residue on private lands than on National Forest lands for the statewide sample.

RESIDUE IN CALIFORNIA WAS LARGER THAN IN THE DOUGLAS-FIR REGION

In 1969, the logging residue measured in California was larger on the average than that sampled in the Douglas-fir region of Oregon and Washington. The study data indicate that 47 percent of the net volume in California was in pieces 28 inches in diameter or larger, and 76 percent was at least 20 feet long or longer. In the Douglas-fir region, only 24 and 32 percent, respectively, of the net volume is in these two size classes. A major influence on the greater volume of larger material in California is the redwood-Douglas-fir stands of the coastal area where large, low quality logs are common. This type of material can present a serious problem in terms of mobility of men and equipment related to intensive management.

OVER 38 PERCENT OF THE NET VOLUME WAS FROM DEAD TREES

For the State as a whole, over 38 percent of the net volume of residue in 1969 was from trees dead at the time of

logging. In the private sector, residue from dead trees accounted for 586 cubic feet per acre, or 43 percent of the average net volume. The average on the National Forests was lower, with 375 cubic feet per acre originating from dead trees. These figures are much higher than those for the Douglas-fir region where only 15 percent of the net volume came from dead trees. As mentioned earlier, these figures underestimate the volume of dead material before the logging operation.

PRIVATE SECTOR HAS A LARGE VOLUME OF LIMBWOOD

As table 14 indicates, the average volume of limbwood over 4 inches in diameter on private lands was 188 cubic feet per acre in 1969. This is equivalent to 14 percent of the average net volume of residue. This compares with just over 1 percent for the Douglas-fir region. The large volume of limbwood on private lands was characteristic of the redwood type, where limbs in excess of 20 inches in diameter are common. On National Forests in California, the volume of limbwood was equivalent to 3 percent of the net volume.

TOTAL NET VOLUME OF RESIDUE FOR ALL OWNERS WAS 321 MILLION CUBIC FEET

The total net volume of logging residue in California was estimated to be 321 million cubic feet in 1969, about 75 percent of the total gross volume.

The total net volume is equivalent to about 1.9 times the wood consumed by the State's pulp and board industries in 1968.[5/] However, unfavorable factors such as wide geographic dispersion, low per-acre volume in some areas, and abundance of mill residues inhibit utilization of logging residue. In the past decade, the timber industry has discovered the existence of valuable clear wood in redwood logs with large epicormic branches. Many of these logs left during the early logging operations will be removed during subsequent logging of the residual stand.

As was the case in the Douglas-fir region, much of the estimated total residue for 1969 is nonexistent today because of decay, burning, and relogging.

[5/] *B. R. Barrette, D. R. Gedney, and D. D. Oswald. California timber industries - 1968 - mill characteristics and wood supply. State Calif. Div. For., 117 p., illus.* [n.d.]

APPENDIX

SCOPE AND PROCEDURE OF STUDY

This study, conducted during 1969-70, involved 76 sample units in Oregon, Washington, and California. The National Forests of western Washington were sampled during the summer of 1969, the remainder of the areas during 1970. Three ownership classes were recognized: National Forest, other public (all lands owned or managed by public agencies other than U. S. Forest Service), and all private owners. The study involved only clearcut operations in the Douglas-fir region of western Oregon and western Washington. In the ponderosa pine region of eastern Oregon and eastern Washington and in California, all types of logging operations were sampled.

For each of the study areas, the sample was allocated to each ownership class in proportion to the annual log harvest attributed to the class. Within each ownership class, the sample was randomly selected from available records of cutover areas. The final allocation of sample units is shown below:

	National Forest	Other public	Private
Douglas-fir region	22	8	24
Ponderosa pine region	5	6/ 1	4
California	6	--	6

6/ *Included with National Forest for tabulation and discussion.*

The survey was conducted using the line intersect method introduced in New Zealand.[7/] This method requires recording only the diameter of residue material intersected by a sampling line of no width. The sum of the square of these diameters and the total length of sampling line is translated into an estimate of the per-acre volume of residue.

For this study, a sample unit consisted of 30 chains of line transect located in each of the randomly selected cutover areas. To insure a degree of randomness and to improve the distribution over the sample area, the direction of the sampling line was changed every 5 chains, as shown in figure 1.

No attempt was made to integrate criteria related to form, minimum length of sound wood, or log grade.

Table 1 shows the sampling error by ownership class for each geographic area. These figures represent the weighted sampling errors for the mean residue volumes at the 68-percent probability level.

7/ *W. G. Warren and P. F. Olsen. A line intersect technique for assessing logging waste. Forest Sci. 10: 267-276, illus., 1964.*

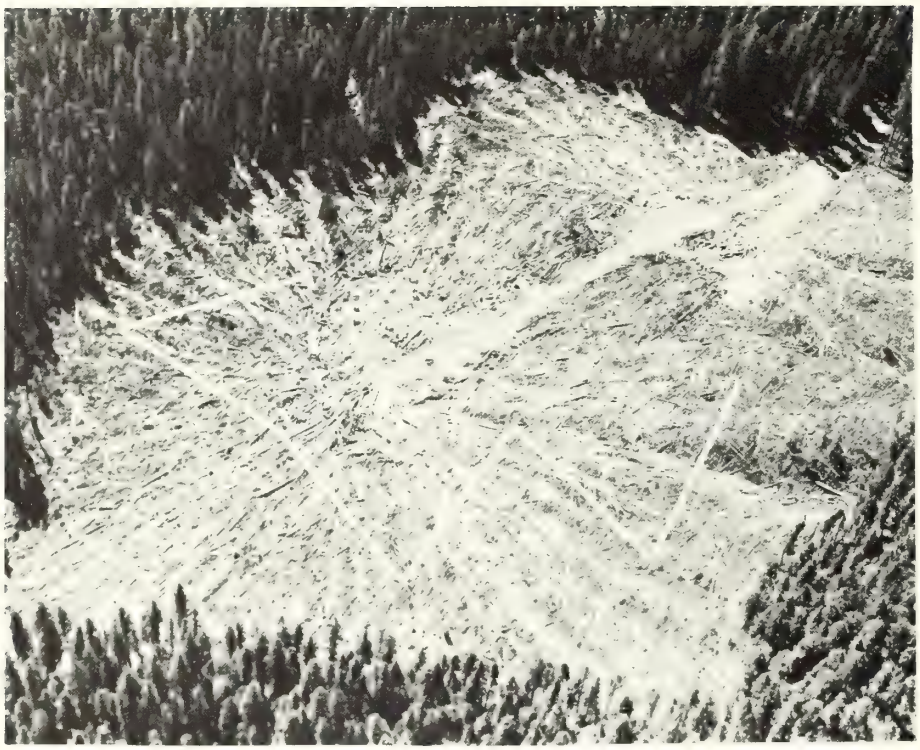


Figure 1.—Example of layout of 30-chain line transect, with random direction change every 5 chains.

TABLE 1.--AVERAGE VOLUME AND SAMPLING ERROR, BY OWNERSHIP CLASS AND GEOGRAPHIC AREA

Geographic area	National Forest		Other public		Private	
	Average volume (net)	Sampling error[1]	Average volume (net)	Sampling error[1]	Average volume (net)	Sampling error[1]
	Cubic feet per acre	*Percent*	*Cubic feet per acre*	*Percent*	*Cubic feet per acre*	*Percent*
Douglas-fir region	3,127	±17.4	2,025	±21.3	1,328	±17.4
Ponderosa pine region	[2]291	±56.4	--	--	352	±25.8
California	1,168	±46.2	--	--	1,370	±58.8

[1] These figures represent the weighted sampling errors expressed as a percent of the average (at the 68-percent probability level).

[2] Includes one sample unit on Indian land in eastern Washington.

DEFINITIONS

Logging residue: All material at least 4 inches in diameter and 4 feet long left on the ground after a logging operation; excluded are upright stumps and punky logs rotten to the point of losing cylindrical form.

- **Live residue** — Residue from trees killed during, or as a result of, logging.
- **Dead residue** — Residue from trees, or parts of trees, that were dead before logging occurred.

Volume:

- **Gross** — Total cubic volume of a piece of residue by diameter and length.
- **Net** — The portion of a piece of residue capable of producing a sound pulp chip, with a 10-percent minimum; does not include rotten, shattered, or missing parts.

Class of residue:

- **Bucked log** — A log that had one or both ends severed by sawing but was left as residue because of length, form, quality, lost log, etc.
- **Breakage** — A log broken on both ends as a result of the felling operation; differs from a bucked log in that neither end was cut off during bucking.
- **Slab or splinter** — A fragmented portion of a log or tree that has minimum dimensions of 4 inches by 5 inches and is at least 4 feet long.
- **Long butt** — A bucked-out segment of the tree adjacent to the stump, left because of poor form or quality.
- **Full tree or top** — A tree, or portion of a tree, with the limbs and top still connected, usually left because of size, form, or excessive limbiness.
- **Limbwood** — A limb separated from the tree by breakage or sawing that is at least 4 inches in diameter and at least 4 feet long.

Residue diameter:

Log or limb	By the line transect method, the diameter is taken at the point of intersection of the sample line; the diameter is the midpoint diameter for a particular classification, such as length class.
Slab or splinter	The circular diameter corresponding to the area of the rectangle as measured by width and depth of the material.
Barkable:	Capable of being barked by a mechanical barker.
Nonbarkable:	Not capable of being barked by a mechanical barker; some of the residue in this class could be barked by a hydraulic barker.
Line transect:	A sample line of no width, i.e., a vertical plane, traversing the cutover area, used to sample residue volume.
Sample unit:	A 30-chain segment of line transect; for this study, line direction was randomly changed every 5 chains.
Utility log:	Defined by the log scaling and grading bureaus as a log that has a usable chip content of at least 50 percent of its gross volume, a minimum diameter of 6 inches, and a minimum length of 12 feet.

TABLE 2.--AVERAGE NET AND GROSS VOLUME OF LOGGING RESIDUE, BY OWNERSHIP, DIAMETER, AND LENGTH CLASSES, DOUGLAS-FIR REGION, 1969

Ownership and diameter classes (inches)	Average, all classes		Length class (feet)							
			4.0-7.9		8.0-11.9		12.0-19.9		20.0+	
	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net
	Cubic feet per acre									
National Forest:										
4.0- 7.9	244	225	41	35	46	42	77	71	80	77
8.0-11.9	553	493	79	64	117	102	172	157	185	170
12.0-15.9	648	511	99	64	151	132	214	179	184	136
16.0-19.9	472	327	46	29	122	77	144	109	160	112
20.0-23.9	423	282	72	48	63	43	160	107	128	84
24.0-27.9	420	254	75	55	65	39	114	72	166	88
28.0-35.9	942	541	106	57	103	60	274	169	459	255
36.0+	656	350	85	27	45	18	93	33	433	272
Slabs	190	144	48	36	46	30	83	68	13	10
Total	4,548	3,127	651	415	758	543	1,331	965	1,808	1,204
Other public:										
4.0- 7.9	222	202	37	31	52	45	57	54	76	72
8.0-11.9	375	330	47	38	73	58	115	101	140	133
12.0-15.9	263	219	17	11	77	59	85	71	84	78
16.0-19.9	274	218	41	33	43	38	86	75	104	72
20.0-23.9	231	173	40	30	50	42	51	42	90	59
24.0-27.9	141	71	14	13	28	15	44	22	55	21
28.0-35.9	485	345	61	42	80	52	162	146	182	105
36.0+	441	317	30	27	44	17	69	62	298	211
Slabs	215	150	59	43	64	43	27	21	65	43
Total	2,647	2,025	346	268	511	369	696	594	1,094	794
Private:										
4.0- 7.9	182	178	52	50	39	38	48	47	43	43
8.0-11.9	324	309	62	58	61	58	108	103	93	90
12.0-15.9	214	199	31	29	35	30	82	79	66	61
16.0-19.9	144	128	19	19	25	22	57	50	43	37
20.0-23.9	98	84	17	15	27	20	27	23	27	26
24.0-27.9	43	36	5	4	5	4	9	7	24	21
28.0-35.9	79	57	14	11	24	19	29	22	12	5
36.0+	212	175	41	38	40	35	105	87	26	15
Slabs	195	162	55	46	52	42	62	51	26	23
Total	1,491	1,328	296	270	308	268	527	469	360	321

TABLE 3.--AVERAGE NET AND GROSS VOLUME OF LOGGING RESIDUE, BY OWNERSHIP, DIAMETER, AND LENGTH CLASSES, PONDEROSA PINE REGION, 1969

Ownership and diameter classes (inches)	Average, all classes		Length class (feet)							
			4.0-7.9		8.0-11.9		12.0-19.9		20.0+	
	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net
	Cubic feet per acre									
National Forest:[1/]										
4.0- 7.9	70	66	8	6	9	9	32	31	21	20
8.0-11.9	104	101	7	7	12	12	44	42	41	40
12.0-15.9	34	27	12	9	11	10	9	6	2	2
16.0-19.9	49	29	28	19	4	3	0	0	17	7
20.0-23.9	6	2	0	0	0	0	6	2	0	0
24.0-27.9	16	8	0	0	0	0	0	0	16	8
28.0-35.9	58	46	0	0	0	0	0	0	58	46
36.0+	18	11	0	0	0	0	0	0	18	11
Slabs	1	1	1	1	0	0	0	0	0	0
Total	356	291	56	42	36	34	91	81	173	134
Private:										
4.0- 7.9	99	98	19	19	19	19	37	37	24	23
8.0-11.9	78	72	13	13	21	21	19	18	25	20
12.0-15.9	54	52	0	0	5	4	29	28	20	20
16.0-19.9	67	59	20	18	0	0	23	22	24	19
20.0-23.9	59	41	29	15	0	0	0	0	30	26
24.0-27.9	0	0	0	0	0	0	0	0	0	0
28.0-35.9	17	11	0	0	0	0	0	0	17	11
36.0+	0	0	0	0	0	0	0	0	0	0
Slabs	22	19	17	14	5	5	0	0	0	0
Total	396	352	98	79	50	49	108	105	140	119

[1/] Includes one sample unit on Indian land in eastern Washington.

TABLE 4.--AVERAGE NET AND GROSS VOLUME OF LOGGING RESIDUE, BY OWNERSHIP, DIAMETER, AND LENGTH CLASSES, CALIFORNIA, 1969

Ownership and diameter classes (inches)	Average, all classes		Length class (feet)							
			4.0-7.9		8.0-11.9		12.0-19.9		20.0+	
	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net
	Cubic feet per acre									
National Forest:										
4.0- 7.9	121	114	31	27	17	16	18	17	55	54
8.0-11.9	238	214	32	24	32	29	44	39	130	122
12.0-15.9	97	85	15	15	5	2	21	20	56	48
16.0-19.9	144	101	19	18	36	14	8	1	81	68
20.0-23.9	144	98	15	11	13	8	13	13	103	66
24.0-27.9	121	58	0	1	57	32	0	0	64	25
28.0-35.9	306	243	53	38	25	25	0	0	228	180
36.0+	228	197	0	0	0	0	0	0	228	197
Slabs	61	58	26	24	4	4	6	5	25	25
Total	1,460	1,168	191	158	189	130	110	95	970	785
Private:										
4.0- 7.9	69	64	11	9	14	13	13	12	31	30
8.0-11.9	115	106	31	27	8	6	35	32	41	41
12.0-15.9	179	152	34	20	15	10	35	31	95	91
16.0-19.9	78	57	18	9	18	12	0	0	42	36
20.0-23.9	112	95	0	0	13	13	0	0	99	82
24.0-27.9	90	63	0	0	0	0	18	18	72	45
28.0-35.9	178	105	0	0	0	0	25	22	153	83
36.0+	999	669	45	23	0	0	0	0	954	646
Slabs	85	59	4	0	22	4	0	0	59	55
Total	1,905	1,370	143	88	90	58	126	115	1,546	1,109

TABLE 5.--TOTAL NET VOLUME OF LOGGING RESIDUE, BY OWNERSHIP, DIAMETER, AND LENGTH CLASSES, DOUGLAS-FIR REGION, 1969

Ownership and diameter classes (inches)	Total, all classes	Length class (feet)			
		4.0-7.9	8.0-11.9	12.0-19.9	20.0+
	Thousand cubic feet				
National Forest:					
4.0- 7.9	10,241	1,623	1,899	3,230	3,489
8.0-11.9	22,292	2,878	4,622	7,128	7,664
12.0-15.9	23,092	2,901	5,937	8,051	6,203
16.0-19.9	14,795	1,283	3,518	4,970	5,024
20.0-23.9	12,800	2,131	1,973	4,898	3,798
24.0-27.9	11,514	2,504	1,739	3,206	4,065
28.0-35.9	24,527	2,592	2,690	7,666	11,579
36.0+	15,838	1,219	833	1,470	12,316
Slabs	6,511	1,663	1,335	3,064	449
Total	141,610	18,794	24,546	43,683	54,587
Other public:					
4.0- 7.9	10,134	1,550	2,243	2,717	3,624
8.0-11.9	16,502	1,863	2,914	5,040	6,685
12.0-15.9	10,977	602	2,891	3,557	3,927
16.0-19.9	10,890	1,614	1,932	3,761	3,583
20.0-23.9	8,681	1,506	2,098	2,085	2,992
24.0-27.9	3,512	648	745	1,081	1,038
28.0-35.9	17,282	2,073	2,621	7,356	5,232
36.0+	15,829	1,325	879	3,094	10,531
Slabs	7,459	2,133	2,111	1,058	2,157
Total	101,266	13,314	18,434	29,749	39,769
Private:					
4.0- 7.9	28,985	8,202	6,023	7,740	7,020
8.0-11.9	50,607	9,430	9,514	16,754	14,909
12.0-15.9	32,525	4,778	4,859	12,795	10,093
16.0-19.9	20,861	3,202	3,572	8,231	5,856
20.0-23.9	13,704	2,405	3,367	3,698	4,234
24.0-27.9	5,884	577	622	1,211	3,474
28.0-35.9	9,439	1,746	3,142	3,752	799
36.0+	28,681	6,171	5,872	14,239	2,399
Slabs	26,600	7,512	7,024	8,279	3,785
Total	217,286	44,023	43,995	76,699	52,569

TABLE 6.--TOTAL NET VOLUME OF LOGGING RESIDUE, BY OWNERSHIP, DIAMETER, AND LENGTH CLASSES, PONDEROSA PINE REGION, 1969

Ownership and diameter classes (inches)	Total, all classes	Length class (feet)			
		4.0-7.9	8.0-11.9	12.0-19.9	20.0+
	Thousand cubic feet				
National Forest:[1]					
4.0- 7.9	13,539	1,231	1,846	6,359	4,103
8.0-11.9	20,718	1,436	2,462	8,615	8,205
12.0-15.9	5,538	1,846	2,051	1,231	410
16.0-19.9	5,949	3,898	615	0	1,436
20.0-23.9	410	0	0	410	0
24.0-27.9	1,641	0	0	0	1,641
28.0-35.9	9,436	0	0	0	9,436
36.0+	2,256	0	0	0	2,256
Slabs	205	205	0	0	0
Total	59,692	8,616	6,974	16,615	27,487
Private:					
4.0- 7.9	7,558	1,465	1,465	2,854	1,774
8.0-11.9	5,554	1,003	1,620	1,388	1,543
12.0-15.9	4,011	0	308	2,160	1,543
16.0-19.9	4,550	1,388	0	1,697	1,465
20.0-23.9	3,162	1,157	0	0	2,005
24.0-27.9	0	0	0	0	0
28.0-35.9	848	0	0	0	848
36.0+	0	0	0	0	0
Slabs	1,466	1,080	386	0	0
Total	27,149	6,093	3,779	8,099	9,178

[1] Primarily National Forest but also includes some land owned or administered by other public agencies.

TABLE 7.--TOTAL NET VOLUME OF LOGGING RESIDUE, BY OWNERSHIP, DIAMETER, AND LENGTH CLASSES, CALIFORNIA, 1969

Ownership and diameter classes (inches)	Total, all classes	Length class (feet)			
		4.0-7.9	8.0-11.9	12.0-19.9	20.0+
	Thousand cubic feet				
National Forest:[1]					
4.0- 7.9	12,456	2,959	1,726	1,923	5,848
8.0-11.9	23,296	2,649	3,114	4,254	13,279
12.0-15.9	9,284	1,655	197	2,177	5,255
16.0-19.9	11,024	1,983	1,517	88	7,436
20.0-23.9	10,709	1,158	957	1,368	7,226
24.0-27.9	6,292	0	3,519	0	2,773
28.0-35.9	26,332	4,149	2,680	0	19,503
36.0+	21,412	0	0	0	21,412
Slabs	6,352	2,631	418	552	2,751
Total	127,157	17,184	14,128	10,362	85,483
Private:					
4.0- 7.9	9,083	1,233	1,843	1,748	4,259
8.0-11.9	15,002	3,890	911	4,435	5,766
12.0-15.9	21,383	2,764	1,379	4,370	12,870
16.0-19.9	8,031	1,290	1,753	0	4,988
20.0-23.9	13,512	0	1,780	0	11,732
24.0-27.9	8,969	0	0	2,563	6,406
28.0-35.9	14,913	0	0	3,139	11,774
36.0+	94,673	3,212	0	0	91,461
Slabs	8,388	50	544	0	7,794
Total	193,954	12,439	8,210	16,255	157,050

[1] Primarily National Forest but also includes some land owned or administered by other public agencies.

TABLE 8.--AVERAGE NET VOLUME OF LOGGING RESIDUE, BY OWNERSHIP, DIAMETER, AND PERCENT CHIPPABLE CLASSES, DOUGLAS-FIR REGION, 1969

Ownership and diameter classes (inches)	Average, all classes	Percent chippable class				
		1-20	21-40	41-60	61-80	81+
		Cubic feet per acre				
National Forest:						
4.0- 7.9	225	0	1	6	17	201
8.0-11.9	493	0	2	11	62	418
12.0-15.9	511	0	11	31	116	353
16.0-19.9	327	6	6	40	50	225
20.0-23.9	282	5	12	41	86	138
24.0-27.9	254	1	1	30	95	127
28.0+	891	10	142	99	302	338
Slabs	144	0	3	9	54	78
Total	3,127	22	178	267	782	1,878
Other public:						
4.0- 7.9	202	0	3	5	26	168
8.0-11.9	330	1	3	18	38	270
12.0-15.9	219	0	2	26	41	150
16.0-19.9	218	0	4	19	83	112
20.0-23.9	173	0	13	40	49	71
24.0-27.9	71	2	5	8	33	23
28.0+	662	0	35	90	208	329
Slabs	150	0	14	31	70	35
Total	2,025	3	79	237	548	1,158
Private:						
4.0- 7.9	178	0	0	1	13	164
8.0-11.9	309	0	1	8	40	260
12.0-15.9	199	0	9	5	40	145
16.0-19.9	128	0	6	13	32	77
20.0-23.9	84	1	3	6	28	46
24.0-27.9	36	0	3	3	8	22
28.0+	232	2	14	41	29	146
Slabs	162	3	5	28	46	80
Total	1,328	6	41	105	236	940

TABLE 9.--AVERAGE NET VOLUME OF LOGGING RESIDUE, BY OWNERSHIP, DIAMETER, AND PERCENT CHIPPABLE CLASSES, PONDEROSA PINE REGION, 1969

Ownership and diameter classes (inches)	Average, all classes	Percent chippable class				
		1-20	21-40	41-60	61-80	81+
		Cubic feet per acre				
National Forest:[1/]						
4.0- 7.9	66	0	0	2	1	63
8.0-11.9	101	2	0	5	3	91
12.0-15.9	27	0	0	6	8	13
16.0-19.9	29	1	0	3	22	3
20.0-23.9	2	0	2	0	0	0
24.0-27.9	8	0	0	0	0	8
28.0+	57	0	0	20	12	25
Slabs	1	0	0	0	1	0
Total	291	3	2	36	47	203
Private:						
4.0- 7.9	98	0	1	0	4	93
8.0-11.9	72	0	0	3	2	67
12.0-15.9	52	0	0	8	11	33
16.0-19.9	59	0	0	18	7	34
20.0-23.9	41	0	0	15	26	0
24.0-27.9	0	0	0	0	0	0
28.0+	11	0	11	0	0	0
Slabs	19	0	0	7	3	9
Total	352	0	12	51	53	236

[1/] Includes one sample unit on Indian land in eastern Washington.

TABLE 10.--AVERAGE NET VOLUME OF LOGGING RESIDUE, BY OWNERSHIP, DIAMETER, AND PERCENT CHIPPABLE CLASSES, CALIFORNIA, 1969

Ownership and diameter classes (inches)	Average, all classes	Percent chippable class				
		1-20	21-40	41-60	61-80	81+
		Cubic feet per acre				
National Forest:						
4.0- 7.9	114	0	1	3	3	107
8.0-11.9	214	1	6	12	22	173
12.0-15.9	85	0	0	10	10	65
16.0-19.9	101	1	1	23	7	69
20.0-23.9	98	0	5	15	47	31
24.0-27.9	58	0	0	41	17	0
28.0+	440	0	20	62	159	199
Slabs	58	0	0	0	5	53
Total	1,168	2	33	166	270	697
Private:						
4.0- 7.9	64	0	0	3	3	58
8.0-11.9	106	1	0	7	2	96
12.0-15.9	152	2	0	2	28	120
16.0-19.9	57	0	6	5	8	38
20.0-23.9	95	0	0	19	22	54
24.0-27.9	63	2	0	13	13	35
28.0+	774	0	126	277	296	75
Slabs	59	0	0	0	17	42
Total	1,370	5	132	326	389	518

TABLE 11.--TOTAL NET VOLUME OF LOGGING RESIDUE, BY OWNERSHIP, DIAMETER, AND PERCENT CHIPPABLE CLASSES, DOUGLAS-FIR REGION, 1969

Ownership and diameter classes (inches)	Total, all classes	Percent chippable class				
		1-20	21-40	41-60	61-80	81+
		Thousand cubic feet				
National Forest:						
4.0- 7.9	10,241	0	46	278	788	9,129
8.0-11.9	22,292	0	102	508	2,793	18,889
12.0-15.9	23,092	0	506	1,415	5,255	15,916
16.0-19.9	14,795	250	292	1,792	2,250	10,211
20.0-23.9	12,800	243	527	1,863	3,889	6,278
24.0-27.9	11,514	44	44	1,378	4,312	5,736
28.0+	40,365	432	6,425	4,485	13,669	15,354
Slabs	6,511	0	136	407	2,441	3,527
Total	141,610	969	8,078	12,126	35,397	85,040
Other public:						
4.0- 7.9	10,134	0	92	217	1,299	8,526
8.0-11.9	16,502	50	122	942	1,928	13,460
12.0-15.9	10,977	0	98	1,290	2,101	7,488
16.0-19.9	10,890	0	238	939	4,147	5,566
20.0-23.9	8,681	0	632	1,993	2,494	3,562
24.0-27.9	3,512	131	262	393	1,573	1,153
28.0+	33,111	0	1,807	4,521	10,376	16,407
Slabs	7,459	0	698	1,568	3,478	1,715
Total	101,266	181	3,949	11,863	27,396	57,877
Private:						
4.0- 7.9	28,985	0	21	238	2,185	26,541
8.0-11.9	50,607	0	57	1,195	6,713	42,642
12.0-15.9	32,525	0	1,364	885	6,664	23,612
16.0-19.9	20,861	0	989	2,100	5,062	12,710
20.0-23.9	13,704	254	463	908	4,633	7,446
24.0-27.9	5,884	0	454	423	1,199	3,808
28.0+	38,120	309	2,477	6,774	4,697	23,863
Slabs	26,600	430	811	4,565	7,606	13,188
Total	217,286	993	6,636	17,088	38,759	153,810

TABLE 12.--TOTAL NET VOLUME OF LOGGING RESIDUE, BY OWNERSHIP, DIAMETER, AND PERCENT CHIPPABLE CLASSES, PONDEROSA PINE REGION, 1969

Ownership and diameter classes (inches)	Total, all classes	Percent chippable class				
		1-20	21-40	41-60	61-80	81+
		Thousand cubic feet				
National Forest:[1]						
4.0- 7.9	13,539	0	0	410	205	12,924
8.0-11.9	20,718	410	0	1,026	615	18,667
12.0-15.9	5,538	0	0	1,231	1,641	2,666
16.0-19.9	5,949	205	0	615	4,514	615
20.0-23.9	410	0	410	0	0	0
24.0-27.9	1,641	0	0	0	0	1,641
28.0+	11,692	0	0	4,103	2,461	5,128
Slabs	205	0	0	0	205	0
Total	59,692	615	410	7,385	9,641	41,641
Private:						
4.0- 7.9	7,558	0	77	0	308	7,173
8.0-11.9	5,554	0	0	232	154	5,168
12.0-15.9	4,011	0	0	617	849	2,545
16.0-19.9	4,550	0	0	1,388	540	2,622
20.0-23.9	3,162	0	0	1,157	2,005	0
24.0-27.9	0	0	0	0	0	0
28.0+	848	0	848	0	0	0
Slabs	1,466	0	0	540	231	695
Total	27,149	0	925	3,934	4,087	18,203

[1] Primarily National Forest but also includes some land owned or administered by other public agencies.

TABLE 13.--TOTAL NET VOLUME OF LOGGING RESIDUE, BY OWNERSHIP, DIAMETER, AND PERCENT CHIPPABLE CLASSES, CALIFORNIA, 1969

Ownership and diameter classes (inches)	Total, all classes	Percent chippable class				
		1-20	21-40	41-60	61-80	81+
		Thousand cubic feet				
National Forest:[1]						
4.0- 7.9	12,456	16	120	305	316	11,699
8.0-11.9	23,296	78	677	1,279	2,368	18,894
12.0-15.9	9,284	0	0	1,072	1,078	7,134
16.0-19.9	11,024	88	88	2,473	788	7,587
20.0-23.9	10,709	0	547	1,641	5,124	3,397
24.0-27.9	6,292	0	0	4,443	1,849	0
28.0+	47,744	0	2,144	6,828	17,273	21,499
Slabs	6,352	0	0	0	585	5,767
Total	127,157	182	3,576	18,041	29,381	75,977
Private:						
4.0- 7.9	9,083	46	0	402	367	8,268
8.0-11.9	15,002	85	0	929	356	13,632
12.0-15.9	21,383	262	0	320	3,920	16,881
16.0-19.9	8,031	0	888	720	1,139	5,284
20.0-23.9	13,512	0	0	2,716	3,146	7,650
24.0-27.9	8,969	256	0	1,794	1,794	5,125
28.0+	109,586	0	17,767	39,231	41,918	10,670
Slabs	8,388	50	0	0	2,447	5,891
Total	193,954	699	18,655	46,112	55,087	73,401

[1] Primarily National Forest but also includes some land owned or administered by other public agencies.

TABLE 14.--AVERAGE NET VOLUME OF LOGGING RESIDUE, BY AREA, OWNERSHIP CLASS, AND TYPE OF MATERIAL,[1] 1969

Area and ownership class	Average, all classes	Roundwood				Slabs and splinters
		Bucked log	Breakage	Full tree or top	Limbwood	
	Cubic feet per acre					
Douglas-fir region:						
National Forest	[2]3,153	1,674	1,014	284	37	144
Other public	2,054	977	542	357	29	149
Private	1,344	192	632	342	16	162
Ponderosa pine region:						
National Forest[3]	312	70	57	163	21	1
Private	376	30	110	193	24	19
California:						
National Forest	1,205	401	80	629	37	58
Private	1,558	141	314	856	188	59

[1] See "Definitions."

[2] Will not balance with other tables when limbwood is subtracted, because limbwood in the western Washington sample could not be separated.

[3] Includes one sample unit on Indian land in eastern Washington.

TABLE 15.--TOTAL NET VOLUME OF LOGGING RESIDUE, BY AREA, OWNERSHIP CLASS, AND TYPE OF MATERIAL,[1] 1969

Area and ownership class	Average, all classes	Roundwood				Slabs and splinters
		Bucked log	Breakage	Full tree or top	Limbwood	
	Thousand cubic feet					
Douglas-fir region:						
National Forest	[2]142,761	75,747	45,898	12,842	1,775	6,499
Other public	102,706	48,833	27,100	17,874	1,440	7,459
Private	219,845	31,375	103,405	55,906	2,559	26,600
Ponderosa pine region:						
National Forest[3]	64,000	14,359	11,692	33,436	4,308	205
Private	29,000	2,314	8,484	14,886	1,851	1,465
California:						
National Forest[3]	131,165	43,589	8,700	68,516	4,008	6,352
Private	220,630	19,977	44,500	121,089	26,676	8,388

[1] See "Definitions."

[2] Will not balance with other tables when limbwood is subtracted, because limbwood in the western Washington sample could not be separated.

[3] Primarily National Forest but also includes some land owned or administered by other public agencies.

TABLE 16.--AVERAGE GROSS AND NET VOLUME OF LIVE AND DEAD, BARKABLE AND NONBARKABLE LOGGING RESIDUE, BY AREA AND OWNERSHIP CLASS, 1969

Area and ownership class	Average, live and dead		Live						Dead					
			Average, all live		Barkable		Nonbarkable		Average, all dead		Barkable		Nonbarkable	
	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net
	Cubic feet per acre													
Douglas-fir region:														
National Forest	4,548	3,127	3,303	2,512	2,614	2,115	689	397	1,245	615	869	551	376	64
Other public	2,647	2,025	1,552	1,383	1,250	1,151	302	232	1,095	642	835	521	260	121
Private	1,491	1,328	1,412	1,267	1,159	1,054	253	213	79	61	44	36	35	25
Ponderosa pine region:														
National Forest[1/]	356	291	184	178	162	161	22	17	172	113	123	95	49	18
Private	396	352	386	342	319	278	67	64	10	10	9	9	1	1
California:														
National Forest	1,460	1,168	865	793	818	746	47	47	595	375	594	375	1	0
Private	1,905	1,370	1,141	784	1,123	768	18	16	764	586	754	584	10	2

[1/] Includes one sample unit on Indian land in eastern Washington.

TABLE 17.--TOTAL NET VOLUME OF LIVE AND DEAD, BARKABLE AND NONBARKABLE LOGGING RESIDUE, BY AREA AND OWNERSHIP CLASS, 1969

Area and ownership class	Total, live and dead	Live			Dead		
		Total	Barkable	Nonbarkable	Total	Barkable	Nonbarkable
	Thousand cubic feet						
Douglas-fir region:							
National Forest	141,610	113,759	95,780	17,979	27,851	24,953	2,898
Other public	101,266	69,161	57,559	11,602	32,105	26,054	6,051
Private	217,286	207,305	172,454	34,851	9,981	5,890	4,091
Ponderosa pine region:							
National Forest[1/]	59,692	36,513	33,026	3,487	23,179	19,487	3,692
Private	27,149	26,378	21,442	4,936	771	694	77
California:							
National Forest[1/]	127,157	86,332	81,215	5,117	40,825	40,825	0
Private	193,954	110,993	108,728	2,265	82,961	82,678	283

[1/] Primarily National Forest but also includes some land owned or administered by other public agencies.

TABLE 18.--TOTAL GROSS VOLUME OF LIVE AND DEAD, BARKABLE AND NONBARKABLE LOGGING RESIDUE, BY AREA AND OWNERSHIP CLASS, 1969

Area and ownership class	Total, live and dead	Live			Dead		
		Total	Barkable	Nonbarkable	Total	Barkable	Nonbarkable
	Thousand cubic feet						
Douglas-fir region:							
National Forest	205,184	149,004	117,919	31,085	56,180	39,211	16,969
Other public	132,388	77,619	62,514	15,105	54,769	41,768	13,001
Private	243,983	231,052	189,648	41,404	12,931	7,197	5,734
Ponderosa pine region:							
National Forest[1/]	73,026	37,747	33,234	4,513	35,279	25,231	10,048
Private	30,543	29,774	24,606	5,168	769	693	76
California:							
National Forest[1/]	158,790	94,083	88,970	5,113	64,707	64,596	111
Private	269,607	161,467	158,933	2,534	108,140	106,711	1,429

[1/] Primarily National Forest but also includes some land owned or administered by other public agencies.

TABLE 19.--AVERAGE NET VOLUME OF LOGGING RESIDUE, BY AREA, OWNERSHIP CLASS, AND DISTANCE TO LANDING, 1969

Area and ownership class	Average, all classes	Distance to landing (feet)					
		0-200	201-400	401-600	601-800	801-1,000	1,001+
	Cubic feet per acre						
Douglas-fir region:							
National Forest	3,127	962	504	918	603	140	0
Other public	2,025	1,002	546	134	167	143	33
Private	1,328	1,007	185	115	21	0	0
Ponderosa pine region:							
National Forest[1/]	291	188	87	12	2	2	0
Private	352	352	0	0	0	0	0
California:							
National Forest	1,168	513	200	241	89	125	0
Private	1,370	495	831	44	0	0	0

[1/] Includes one sample unit on Indian land in eastern Washington.

TABLE 20.--TOTAL NET VOLUME OF LOGGING RESIDUE, BY AREA, OWNERSHIP CLASS, AND DISTANCE TO LANDING, 1969

Area and ownership class	Total, all classes	Distance to landing (feet)					
		0-200	201-400	401-600	601-800	801-1,000	1,001+
	Thousand cubic feet						
Douglas-fir region:							
National Forest	141,610	43,504	22,859	41,614	27,320	6,313	0
Other public	101,266	50,015	27,332	6,670	8,383	7,156	1,710
Private	217,286	164,682	30,361	18,871	3,372	0	0
Ponderosa pine region:							
National Forest[1/]	59,692	38,564	17,846	2,462	410	410	0
Private	27,149	27,149	0	0	0	0	0
California:							
National Forest[1/]	127,157	55,830	21,770	26,253	9,731	13,573	0
Private	193,954	70,086	117,714	6,154	0	0	0

[1/] Primarily National Forest but also includes some land owned or administered by other public agencies.

· GPO 1973 [illegible]

Howard, James O.
1973. Logging residue in Washington, Oregon, and California--volume and characteristics. USDA Forest Serv. Resour. Bull. PNW-44, 26 p., illus. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Information is presented on the per-acre and total volume of logging residue by ownership, diameter class, length class, soundness, and type of material for 1969 in Oregon, Washington, and California.

KEYWORDS: Slash, logging, wood waste, Oregon, Washington, California.

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The mission of the PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION is to provide the knowledge, technology, and alternatives for present and future protection, management, and use of forest, range, and related environments.

Within this overall mission, the Station conducts and stimulates research to facilitate and to accelerate progress toward the following goals:

1. Providing safe and efficient technology for inventory, protection, and use of resources.
2. Development and evaluation of alternative methods and levels of resource management.
3. Achievement of optimum sustained resource productivity consistent with maintaining a high quality forest environment.

The area of research encompasses Oregon, Washington, Alaska, and, in some cases, California, Hawaii, the Western States, and the Nation. Results of the research will be made available promptly. Project headquarters are at:

Fairbanks, Alaska
Juneau, Alaska
Bend, Oregon
Corvallis, Oregon
La Grande, Oregon
Portland, Oregon
Olympia, Washington
Seattle, Washington
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The FOREST SERVICE of the U. S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.

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THE TIMBER RESOURCES OF CENTRAL WASHINGTON

james o. howard

Pacific Northwest Forest and Range Experiment Station
U.S. Department of Agriculture

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Acknowledgment is made of the cooperation and assistance of many public agencies and private landowners.

The Division of Timber Management, Region 6, Forest Service, U.S. Department of Agriculture, supplied field plot data for National Forest lands.

The various county assessors furnished ownership information.

The Washington State Department of Natural Resources and Bureau of Indian Affairs made aerial photographs available for interpretation and provided maps for access to forest lands.

The Agricultural Stabilization and Conservation Service made aerial photographs available for interpretation.

Other public agencies and private landowners provided information on access to forest lands.

PREFACE

This report summarizes the findings of the latest inventory of the forests in Chelan, Douglas, Kittitas, Klickitat, Okanogan, and Yakima Counties, Washington. Although part of the central Washington inventory unit, Benton and Grant Counties have no forest land and were not inventoried. Fieldwork on lands outside the National Forests was done in 1967. Fieldwork on the Wenatchee National Forest was done in 1964 and 1965. The portion of the Snoqualmie National Forest in the central Washington area (Naches-Tieton Working Circle) was inventoried in 1964. The inventory of the Okanogan National Forest was done in 1965 and 1966. The fieldwork for the portion of the Gifford Pinchot National Forest in the central Washington area was done in 1969. Previous inventories were completed as follows:

County	*First inventory*	*Second inventory*
Chelan	1934-35	1959-60
Douglas	1934-35	1959-60
Kittitas	1934-35	1953
Klickitat	1935	1954
Okanogan	1935	1958-59
Yakima	1933-34	1957

These inventories were conducted by the Forest Survey, a nationwide project of the Forest Service authorized by the McSweeney-McNary Forest Research Act of 1928 and subsequent amendments. The purposes of the Forest Survey are (1) to obtain comprehensive information on timber resources, including the extent and condition of forest lands, the amount and kind of timber growing on these lands, the rate of forest growth and depletion, the amount of timber cut, and probable future trends in timber requirements, and (2) to analyze and make available survey information needed to formulate forest policies and programs. Resurveys are made periodically to update basic information.

The Forest Survey is conducted throughout the continental United States, Alaska, and Hawaii by the USDA Forest Service Experiment Stations. The Pacific Northwest Forest and Range Experiment Station at Portland, Oregon, is responsible for the States of Alaska, California, Hawaii, Oregon, and Washington.

ABSTRACT

The findings of the latest inventory of the timber resources of central Washington indicate there are 50.9 billion board feet of sawtimber on 4,370,000 acres of commercial forest land. Land owned or administered by public agencies accounts for 73 percent of the area and 84 percent of the sawtimber volume; farmer and miscellaneous private ownerships account for 17 percent of the area but only 9 percent of the volume; and the forest industry sector is smallest, with only 10 percent of the area and 7 percent of the volume.

About 280,000 acres are classified as nonstocked. Much of this occurs in the lower fringe of the forest zone and may not be able to support additional stocking.

Douglas-fir is the most abundant species, occurring on 37 percent of the commercial forest land and accounting for 38 percent of the sawtimber volume. Ponderosa pine is found on 27 percent of the area and accounts for 24 percent of the volume. True firs cover only 10 percent of the area but account for 17 percent of the volume.

Poletimber stands cover 809,000 acres, with about 220,000 acres classified as overstocked. These stands present a problem of reduced future yields unless they are thinned. Harvest exceeds growth by almost 200 million board feet, primarily because of a large volume of old-growth timber and the low overall site productivity of the area.

Recreational use of the forests of central Washington has been increasing rapidly. Associated with this increased demand has been pressure to reserve land area exclusively for recreation use. Presently there are almost 800,000 acres in reserved status.

Keywords: Forest surveys, forest appraisal, Washington (central).

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INTRODUCTION

This report is concerned with the timber resources of central Washington, comprised of eight counties along the eastern slope of the Cascade Range of Washington — Benton, Chelan, Douglas, Grant, Kittitas, Klickitat, Okanogan, and Yakima. This area has just over 33 percent of the total land area of the State of Washington but only 11 percent of the State's population. With only 16 people per square mile, central Washington is the least populous area in Washington. This is a reflection of the lack of a major port or metropolitan area, coupled with a vast acreage of back country without roads along the Cascades and extensive grassland and farmland in the eastern portion of the unit. Yakima and Wenatchee rank fourth and twelfth, respectively, in population among all cities in Washington.

This part of Washington is one of striking contrasts, varying from dry, rolling hills and steep-walled coulees, with grass and sagebrush as the natural vegetation, to the forested slopes and glacier-covered peaks of the Cascade Range. In the forest zone (fig. 1), the annual precipitation reaches 65 inches along the Cascades, much of it as snow. To the east in the nonforest zone, rainfall as low as 6 inches is not uncommon. These two factors, moisture and topography, dictate generally the character of the forests in the area. Along the eastern fringe of the forest zone, the timber stands are scattered and occur mainly as narrow bands of trees in canyon bottoms. These meandering strips of timber merge into sparse ponderosa pine and Oregon white oak forests, which in turn give way to denser

Figure 1.—Forest areas of central Washington.

stands of mixed species in the higher moisture and elevation zones. As a result, a large portion of the timber volume is found along a 30-mile-wide band following the crest of the Cascades,[1] except in eastern Okanogan County where a substantial volume occurs in the Okanogan Highlands.

The forest resource data in this report and the discussions of forest area, volume, growth, and cut relate to the supply of wood available to meet regional and national needs. The information is presented for the use of legislators, service organizations, local and regional planners, investors, forest industry managers, and others interested in the timber situation.

[1] *There is no forest land in either Benton or Grant Counties. In addition, the small portion of forest land in western Douglas County has been included with the Chelan County statistics. The combined figures are reported as Chelan-Douglas in the tables.*

BACKGROUND

The first American settlement in this part of Washington was in 1811 at Fort Okanogan, located at the confluence of the Okanogan and Columbia Rivers. Between 1811 and 1858, fur traders traveled in the central Washington area, but settlement was restricted by continuing Indian troubles.

Following the Indian wars of 1850-57, eastern Washington was declared open for settlement in 1858. The first immigrants were miners attracted to discovery of gold at Fort Colville, Conconully, Similkameen River, and the Swauk District in Kittitas County. Extravagant claims were made, but results fell short of expectations as ground was quickly worked out or the ore proved to be of low grade.

As the excitement of gold fever faded, the people turned to more stable livelihoods, primarily agriculture—growing such crops as fruit and wheat.

Establishment of towns, hampered by Indian problems, preceded statehood by only a few years. Yakima was incorporated in 1883, but the entire town was moved 4 miles north in 1884 to be closer to the Northern Pacific Railway station. The original location was later named Union Gap. The town of Okanogan was established in 1886, followed by Wenatchee in 1888.

The forests of central Washington provided the fuel and building materials needed by the early settlers. The primary products were poles, posts, mine timbers, and hand-hewn boards. The first recorded lumber production was in 1860, from a whipsaw operation on Mill Creek in Klickitat County. The lumber industry remained insignificant through the late 1800's, existing as small operations and responding to local building needs. It was not until the rapid development of the agricultural industry that the forest industry gained a footing as a major industry of central Washington.

The central Washington area had its beginning as a major fruit producer in 1870 when John Beck planted the first apple orchard in the Yakima Valley (Washington State Historical Society 1941). The institution of the first irrigation system near Yakima in 1872 launched the agricultural industry.

As agricultural shipments grew, a need developed for materials for storage and transportation containers. Wooden boxes from the locally abundant ponderosa pine proved to be ideally suited for this purpose, and the apple producers of the Pacific Northwest were the first to use them. In response to this demand, many sawmills began producing box shook for the rapidly expanding agricultural industry. This market, coupled with local and regional building, marked the beginning of the forest industry in central Washington. In 1930, agriculture and forestry accounted for almost 40 percent of the total employment in central Washington; the forest industry contribution was only 2 percent.

The economy changed considerably in the next few decades. By 1969, the proportion employed in the agricultural and forest industries had declined from 40 to 27 percent, although the forest industry itself had grown to 9 percent.

By 1963, Washington led all States in the production of apples, producing almost 32 million bushels (25 percent of the total U.S. production). In addition, Washington produced over 28 percent of the Nation's pears (U.S. Bureau of the Census 1965). Most of this was from central Washington, indicating

the importance of agriculture in the local economy.

Although fruit and vegetables now are shipped mostly in paperboard containers, wooden boxes are still used for bulk movement within processing and storage facilities. Many sawmills which started as box shook producers in the late 1800's have expanded into other products and have a major influence on the local economy.

In 1969, the forest industry of central Washington employed 4,380 people with a payroll of $32 million, about 11 percent of the total payroll (Washington (State) Employment Security Department 1969). Although making up only 9 percent of the total employment, the forest industry accounted for 35 percent of the manufacturing, or export-based, employment. This latter statistic more clearly reveals the importance of the forest industry to the area's economy.

Common to a maturing economy, much of the recent growth has been in the service-oriented sectors, with the cities of Yakima and Wenatchee, in Yakima and Chelan Counties, emerging as the service centers for the central Washington area. In 1969, the forest industry in these two counties accounted for only 5 percent of total employment. On the other hand, in Klickitat and Okanogan Counties, the forest industry accounted for 50 and 23 percent, respectively, of the total employment.

These figures do not include the hundreds of people employed by various agencies which manage and protect the vast holdings of public forest land.

FOREST LAND

Only 41 percent of the total land area is forest land; only 30 percent is commercial forest land

About 6 million acres, 41 percent of the total land area of central Washington, is classified as forest land. About 4.4 million acres, or 30 percent of the total land area, is commercial forest land. This relatively low proportion, compared with 78 percent in western Washington, reflects the vast acreages of nonforest, unproductive, and reserved forest land in central Washington.

The current inventory shows 8.7 million acres of nonforest land, 59 percent of the total land area. This land is characterized by rolling hills, grassland, orchards and other farmland, rocky outcrops, and glaciers, as well as man-made features such as roads and urban areas.

Noncommercial forest land, which includes both unproductive forest land and productive forest land reserved by law or administrative order, occurs throughout the forest zone, occupying about 11 percent of the total land area. Noncommercial rocky forest land and subalpine forests of the upper slopes of the Cascades account for over two-thirds of the unproductive forest land (see figs. 2 and 3).

igure 2. — Noncommercial rocky areas such as this may contain trees of commercial size, but the low density of the trees, the terrain, and difficulty of regeneration preclude harvest operations.

Figure 3. — This subalpine forest, although not growing trees of commercial size or quality, ranks high in esthetic appeal and also provides summer range for livestock.

These lands have massive recreational potential; it is their rugged beauty that is bringing national prominence to this region.

The reserved lands are wholly under public jurisdiction. About 90 percent of the reserved forest land is within National Forest boundaries, and 10 percent is on other public lands.

Commercial forest area is decreasing

Since the previous inventory, the area of commercial forest land in central Washington has decreased about 20,000 acres. Unlike the western portion of the State where urbanization is the major contributing factor to the decline in the commercial forest land base, reclassification is the prime cause of the change in central Washington. The impact of urbanization has been light because most of the towns are located in the nonforest areas. This loss of 20,000 acres reflects the net impact of land use changes between the three major land classes. Some of the shifts are a result of new definitions of land use or different interpretation of existing ones. Other changes are the result of enactment of public statutes.

Not reflected in this loss is the more subtle change associated with the early stages of land development for recreational purposes. In this area and throughout the West, forest land is being subdivided into lots on much of which subsequent development has not occurred and may not occur for some time. Breaking down of large tracts of forest land into small parcels effectively removes the land from the timber producing base. It is this trend that may have the greatest impact on the commercial forest land base in the future.

Seventy-three percent of commercial forest land is under public management

About 73 percent, 3.2 million acres, of the commercial forest land in central Washington is under public management. National Forests and Indian lands account for the largest proportions, 43 percent and 18 percent, respectively. Figure 4 shows land under public management for central Washington. Although much of the public land is in large blocks, there are areas, such as in western Kittitas County, where public and private lands are intermingled. The ownership pattern of this particular area is the result of the railroad grants of the 1800's. Such scattered blocks create problems in management of forest lands because of conflicting objectives for recreational values and road systems.

Private ownership accounts for 27 percent of commercial forest land

Less than 10 percent of the commercial forest land is owned by the forest industry. This is in distinct contrast with western Washington where forest industry accounts for 35 percent of the total commercial forest land. Because of this relatively small share of the commercial forest land, the forest industry in central Washington receives 87 percent of its total log consumption from other owners (Bergvall and Gedney 1970). About 67 percent of the logs consumed are from lands under public management.

The remaining 17 percent of the commercial forest land is held by farmer and miscellaneous private owners. It is this group that is the largest in terms of numbers of owners, with tracts ranging from less than 1 acre to tens of thousands of acres.

Over 280,000 acres are nonstocked

The survey indicates that 282,000 acres of the commercial forest land are currently nonstocked. This amounts to 6.5 percent of the total commercial forest land area, compared with only 4 percent in western Washington. Over two-thirds of the nonstocked area occurs in ponderosa pine type which is the dominant forest type in the lower elevation fringes of

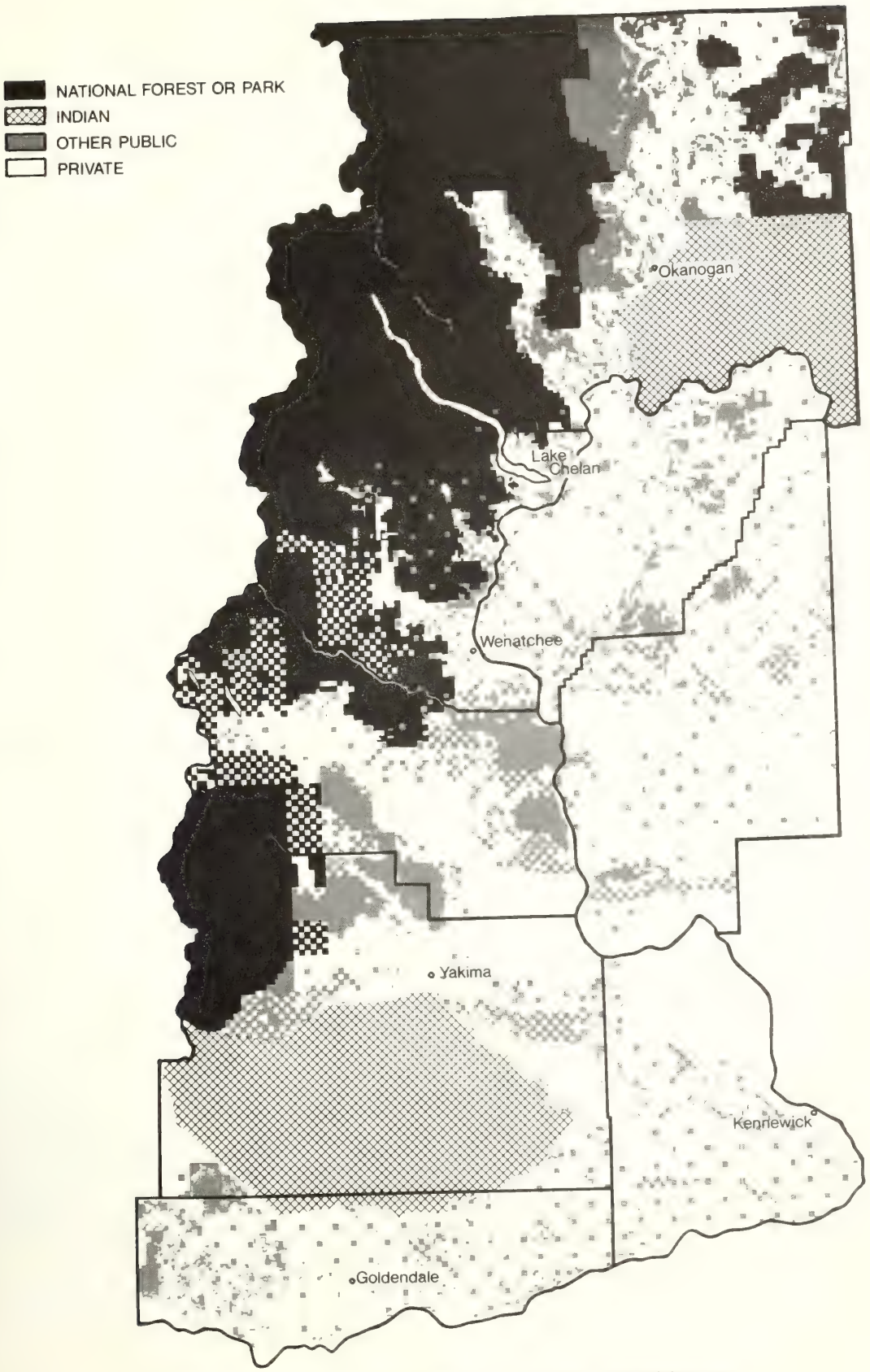

Figure 4. — Ownership map of central Washington.

the forest zone (fig. 5). Okanogan County has almost 50 percent of the nonstocked area.

Figure 5. — This sparsely stocked ponderosa pine stand is located in the outer fringe of the forest zone. There are some indications that areas such as this may actually be stocked to the full capability of the site.

Almost 60 percent of the total nonstocked acreage is found on farm and miscellaneous private land. In addition to being the predominant ownership in the lower elevations of the forest zone, some of these lands were heavily cut over and many have not been adequately restocked.

Since completion of this inventory, special studies have been conducted in arid sites in eastern Oregon and California[2] to determine whether sparsely stocked stands can carry additional stocking. The findings indicate that many of these "nonstocked" and "poorly stocked" areas are actually stocked to their full potential or nearly so. Thus, it is probable that some of the similar areas in central Washington do not have the potential for increased yield through additional stocking.

Douglas-fir and ponderosa pine types occupy almost 64 percent of the commercial forest land

Douglas-fir type is the most extensive forest type in central Washington, covering 1,592,000 acres, over 36 percent of the commercial forest land; ponderosa pine is second, occupying over 27 percent of the commercial forest land. True firs and lodgepole pine account for 10 and 7 percent, respectively. These proportions have changed considerably since the previous inventory. Data from that inventory showed ponderosa pine most extensive, with 47 percent, followed by Douglas-fir, with 28 percent. Although changes in land use classifications have occurred, a major factor is the change in stand composition after harvesting. Many of the pine stands have been selectively cut, leaving the understory species virtually untouched. As a result, in many of these stands, species other than ponderosa pine now make up a majority of the stocking.

The forests of central Washington are nonhomogeneous in nature

One noticeable feature of the forests of central Washington is their nonhomogeneous nature, relative to species, age, and size class. This is attributable in part to the selection method of harvesting timber used in this area and the natural tendency of some of the species to regenerate in small clumps. In addition, the stand composition reflects the transition from moist west-side conditions of the Cascades to the drier east side along the Columbia River.

A study was made of stand composition from Forest Survey inventory data. A pure stand is defined as having 80 percent or more of the stocking in one species. Based on this standard, only 40 percent of all the commercial

[2] *Colin MacLean and Charles Bolsinger. Estimating productivity on sites with a low stocking capacity. (In preparation for publication, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.)*

forests could be classified as pure. Only 36 percent of the Douglas-fir stands were pure; the highest percentage — 59 — occurred in the ponderosa pine stands. This higher proportion is partially due to the occurrence of ponderosa pine in the lower moisture zones, where few other species exist. Douglas-fir, on the other hand, is a transition species, mixing with ponderosa pine where the moisture level permits and extending to the subalpine zone in the higher elevations.

Forest Survey standards define an uneven-aged stand as having less than half of the growing stock stocking in two adjacent 10-year age groups. In the central Washington area, about 43 percent of all stands were classified as uneven-aged. Although 57 percent of the commercial forest area has stands classified as even-aged, much of this area has two or more distinct age and size classes represented (i.e., they are not one-age stands such as found in western Washington). Examples of this are common to the ponderosa pine type where old-growth trees may predominate, but a substantial understory of sapling or poletimber trees exists.

A primary benefit of the mixed-composition stands in central Washington is the ease of managing the stands for both timber production and recreational usage. Records indicate that about 95 percent of the log harvest comes from partial cutting systems. This periodic reentry into stands allows removal of part of the volume without interfering with the esthetic appearance of the area. Even in high-intensity recreation areas, dead or high-risk trees can be removed without disturbing the recreational value of the stand (fig. 6).

Figure 6. — Protection of esthetic values is easier in stands such as this where selection methods of harvesting can be used.

Overstocking of poletimber stands poses a problem

Many of the poletimber stands in central Washington are overstocked and present a problem of reduced future yields unless some thinning is done. With the poor market for small logs that exists in this area, the little thinning that takes place is generally precommercial. The U.S. Forest Service and other agencies maintain thinning programs, but the budget limits these programs (fig. 7).

Analysis of inventory data for areas outside the National Forests indicates that about 60,000 acres of poletimber stands are overstocked. In addition to these stands, about 15 percent of the area that is classified as understocked has clumps of trees that are actually overstocked. This condition is quite common in the ponderosa pine region where uneven-aged stands result in dense patches of reproduction.

On the four National Forests, an even greater proportion of the poletimber stands are overstocked. Based on available statistics, it is estimated that the proportion of acres more than 70 percent stocked on National Forest lands is about 2½ times greater than on all other ownerships. Based on the assumption that this relationship exists for all stocking classes, it is estimated that there are 160,000 acres of overstocked poletimber stands.

Thus, in central Washington, there is a total of 220,000 acres of overstocked poletimber stands, about 28 percent of the total acreage of poletimber stands. Without stocking control, many of these stands will remain stagnated for long periods of time, thereby reducing potential yields. The very little thinning currently being done on either private or public lands reflects the poor gains from thinning and the limited market for small logs.

Figure 7. — A dense poletimber stand in Okanogan County. This stand will have reduced yields due to overstocking unless thinned.

TIMBER VOLUME

Live sawtimber volume totals almost 51 billion board feet

The total sawtimber volume of trees 11.0 inches in diameter and larger for all owners is 50.9 billion board feet, International ¼-inch rule. Hardwoods account for only 122 million board feet, less than one-quarter of 1 percent of the total. In terms of growing-stock volume, softwoods account for 99.5 percent of the 10,974 million cubic-foot total.

Public lands account for 84 percent of the sawtimber volume

The current inventory indicates that just over 84 percent of the sawtimber volume is under public management. The National Forests have the largest share with 28.5 billion board feet, almost 56 percent of the total. In addition, 92 percent of the over-rotation-age sawtimber is located on publicly managed lands. The primary reason for this large share of the sawtimber volume on public lands is the historical pattern of logging in central Washington. Most of the early log harvest came from private lands in the lower portion of the forest zone. Timber harvesting on public lands did not occur in any significant amount until most of the lower elevation stands had been heavily cut over. Also, there was very little timber harvesting on the Yakima Indian Reservation until after World War II.

Volume per acre varies widely by county and ownership

As figure 8 shows, the sawtimber volume per acre varies considerably by ownership from county to county. Okanogan County, with a large acreage of rocky and dry-site land, is lowest among the counties in volume per acre. Yet it ranks second to Yakima County in total sawtimber volume, reflecting the large acreage of commercial forest land, 37 percent of the central Washington total. The high volume per acre on National Forest land in Klickitat County is not significant as it represents only a 9,000-acre block of old-growth timber adjacent to Skamania County. No logging had occurred in this part of the Gifford Pinchot National Forest before 1952, and very little cutting has been done since then.

The relatively high volumes in private land in Chelan-Douglas and Kittitas Counties are not characteristic of the other counties. As a result of the railroad grants of the 1800's,

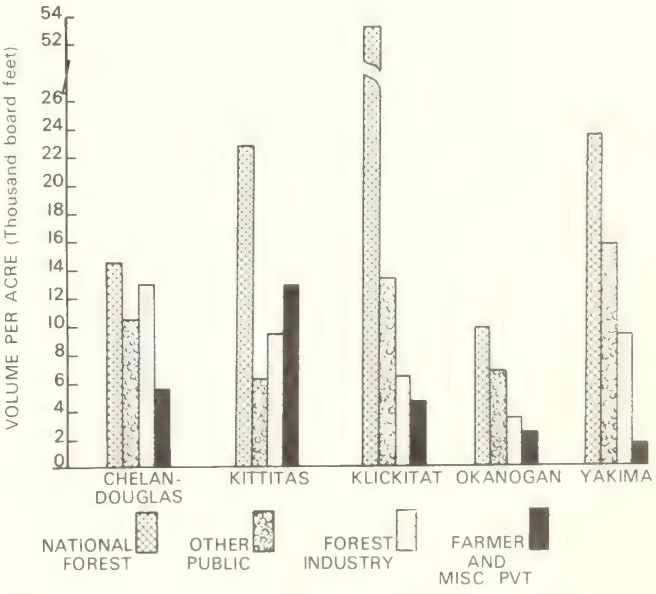

Figure 8. — Volume per acre by county and ownership, central Washington.

private land is intermingled with alternate sections of National Forest land (see fig. 4) and has had only limited access and cutting. This, coupled with its being in the higher volume transition zone, has resulted in per-acre volumes that are higher than other areas of central Washington.

The high volume per acre in the "other public" owner group in Yakima and Klickitat Counties is due to the remaining stands of old-growth timber on the Yakima Indian Reservation.

The "farmer and miscellaneous private" owner group has the lowest average volume per acre in the central Washington area. These lands were heavily cut over during the early years of logging in the area, leaving two-thirds of the forest land currently stocked with less than 5,000 board feet per acre.

Douglas-fir has greatest volume, ponderosa pine second

Douglas-fir is the leading species in terms of sawtimber volume with 19.3 billion board feet, International ¼-inch rule. Ponderosa pine is second with almost 12 billion board feet, followed by the true firs with 8.4 billion board feet. The distribution of volume has changed considerably since the first inventory, at which time ponderosa pine accounted for the largest share of the sawtimber volume, almost 40 percent of the total.

Sawtimber volume of ponderosa pine has decreased 22 percent since the previous inventory

The previous inventory for central Washington, completed during the 1953-60 period, indicates that ponderosa pine accounted for 15.4 billion board feet, International ¼-inch rule, or 27 percent of the total sawtimber volume. The current inventory shows about 12 billion board feet, a 22-percent decrease. During this same period, the sawtimber volume of all other species decreased only 5.5 percent.

A large part of this change is explained by the historical trend in log harvest. Since the beginning of the forest industry in central Washington, ponderosa pine has contributed heavily to the log harvest. In 1925, ponderosa pine accounted for 72 percent of the log harvest. Even though the annual harvest of ponderosa pine has increased slightly since 1925, it now accounts for only 35 percent of the total log harvest. Although producing over one-third of the logs harvested, ponderosa pine is only 24 percent of the total inventory volume. Thus, it is being cut at a more rapid rate than the other species, due to the continued high value of pine products.

Salvable dead volume totals 1.6 billion board feet

The total volume of salvable dead trees is 1.6 billion board feet (International ¼-inch rule). This is 4 percent less than the estimated 5-year mortality for the 1963-67 period. Thus, no appreciable buildup of dead material occurs in this area. The 5-year mortality for all pines is 21 percent greater than their salvable dead volume, reflecting their rapid deterioration.

Douglas-fir accounts for 31 percent of the total salvable dead volume, all pines 24 percent, and the true firs 19 percent. Of the Douglas-fir volume, almost 61 percent is in trees which have a net volume of 500 or more board feet. About 50 percent of the pine volume and 32 percent of the true fir volume are in this category. For all species, less than 2 percent of the total salvable dead volume is in trees with a net volume of 2,500 or more board feet.

Although the total volume of salvable dead material is rather large, the lack of concentrated volumes makes harvesting of much of it economically unfeasible. Only 20 percent is in concentrations of 5,000 or more board feet per acre, and 54 percent is in volumes of less than 2,500 board feet per acre. This is substantially different from western Washington where almost 65 percent occurs in concentrations of 5,000 or more board feet per acre.

GROWTH, CUT, AND MORTALITY

Net annual growth is about 578 million board feet

Net annual growth of sawtimber in central Washington is 578 million board feet (International ¼-inch rule), about 1 percent of the inventory volume. This net annual growth amounts to about 132 board feet per acre, approximately 63 percent of per-acre gross growth. Net annual growth of all growing-stock trees is 121 million cubic feet.

Growth rate is lowest in the National Forests, highest on private lands

As table 1 indicates, the growth rate on National Forest land is less than half that on private lands. This disparity is due to the widely different forest conditions of the two ownership groups. The National Forests contain 65 percent of the old-growth timber, compared with only 9 percent on private lands. In most cases, the net growth rate in older stands is much less than in younger stands. These younger stands are growing about the same number of board feet but on a smaller base. As the old-growth timber on National Forest lands is harvested, the growth rates of these two owner groups will come closer together.

With harvesting concentrated in the old-growth timber, it is to be expected that cut will exceed growth. Unlike managing a second-growth stand on a sustained yield basis, the cut-growth relationship in old-growth timber is not very meaningful.

Western larch has a negative net growth

The net annual growth for western larch is a negative 24.8 million board feet (International ¼-inch rule), of which 21.2 million board feet occurs in Yakima County. An

Table 1. — Per-acre volume[1] and net annual growth, by ownership class, January 1, 1968

Ownership class	Inventory volume per acre	Net growth per acre	Net growth as a percent of inventory volume
	Board feet		*Percent*
National Forests	15,268	131	0.9
Other public	10,908	128	1.2
Forest industry	8,085	150	1.9
Farmer and miscellaneous private	6,011	133	2.2
All owners	11,650	132	1.1

[1] *International ¼-inch rule.*

analysis of all western larch trees tallied in the inventory in Yakima County showed a very high occurrence of dwarf mistletoe; 53 percent of all live sawtimber trees were infected. The analysis also indicated that 72 percent of the sawtimber mortality was caused by disease. For trees greater than 20-inch d.b.h., this proportion was 88 percent. This evidence points to dwarf mistletoe as the probable cause of death. Thus, the negative net growth of western larch was caused by very slow growth of live trees, possibly caused by dwarf mistletoe infestation, and a high rate of mortality, resulting in a large volume loss.

Total cut exceeds total growth by 39 percent

The average annual log harvest in central Washington for the 1965-69 period was 690 million board feet (Scribner scale), which exceeded the net annual growth of 496 million board feet by 39 percent. This relationship is due largely to the low growth rate associated with old-growth timber. This is pointed out in table 2 which shows publicly managed lands, with most of the old-growth timber, having a much larger gap between growth and cut. As mentioned previously, this will continue as long as a majority of the sawtimber volume is in old-growth stands.

Harvest of ponderosa pine exceeds net growth by 211 million board feet

The average annual log harvest of ponderosa pine for 1965-69 was about 340 million board feet (Scribner scale), which exceeds the net annual growth by approximately 211 million board feet. This gap can be accounted for primarily by the great demand for old-growth pine timber and the slow growth of the old-growth pine stands.

The volume of ponderosa pine harvested has increased slightly since 1965. Should this level of harvest continue, the inventory of pine timber will continue to decrease. In the long run, there will be increased utilization of other species.

Two possibilities for increasing the available supply of pine sawtimber would be thinning the dense patches of reproduction and planting cutover areas that are not adequately stocked. In the farmer and miscellaneous private ownership group, about 22 percent of the commercial forest land is nonstocked. Much of this is located in the lower portion of the forest zone where the stocking cannot be increased appreciably. However, restocking of those areas that are poorly stocked after early cutting operations might yield a sizable gain in sawtimber volume for the future.

Growth of true firs exceeds cut by 70 million board feet

The true firs are the only species group for which growth exceeds cut. The annual log harvest of true firs is about 67 million board feet (Scribner scale). The net annual growth is 137 million board feet, 70 million board feet greater than cut. This excess of growth over cut can be attributed mainly to the relatively high growth rate of this species

Table 2. — Growth-cut relationships by ownership class for central Washington, 1965-69

Ownership class	Net annual growth	Average annual log harvest	Log harvest as a percent of growth
	Thousand board feet, Scribner rule		*Percent*
Public	361,800	533,841	148
Private	133,800	156,484	117
Total	495,600	690,325	139

group (1.65 percent of the inventory volume), the more limited market for true firs, and the historical lack of access to many of the true fir stands. Although the harvest of true firs is still limited, it has been increasing rather dramatically. In 1925, only 1 percent of the log harvest was from true firs (Moravets 1949); in 1970, this proportion had reached 17 percent, with the largest part of the increase coming since 1955. This change can be attributed mainly to increased recognition of the value of true firs both for their pulping quality and in the construction industry where their primary use is as framing material.

Much of the true fir type is found in the higher elevations of the Cascade Range in areas of prime recreational and scenic value, where timber management practices are restricted or prohibited. Withdrawal of more of these high altitude areas for recreational use will remove a large share of the true fir type from future timber harvest. If present trends continue, the outlook is for decreasing acreage of available true fir timber, although the annual harvest will not be affected for some time.

Annual mortality is almost 343 million board feet

Average annual mortality in the forests of central Washington is 342.7 million board feet, International ¼-inch rule, about 0.7 percent of the sawtimber inventory. The highest rate occurs in western larch where annual mortality is about 1.5 percent of the sawtimber inventory. Annual mortality in ponderosa pine and Douglas-fir average about 0.6 percent of their respective sawtimber inventories.

Insects and diseases are leading causes of death

Inventory statistics show that insects and diseases were identified as the causal factor for 38 percent of total mortality. An additional 27 percent is attributed to other causes such as wind, animals, and fire. The cause of death for the remaining 35 percent may be partly attributable to insects and diseases but is classified as unknown because of the difficulty in identifying specific causes.

Although no data are available on the volume loss due to specific insects and diseases for this particular area, Childs and Shea (1967) estimated that 57 percent of total volume loss to diseases and insects was attributable to dwarf mistletoe. This parasite is found throughout the central Washington area, attacking pines, Douglas-fir, and western larch. Trees of all ages are attacked, and many of them eventually are killed. Childs and Shea report that the growth loss due to dwarf mistletoe is almost 4 percent greater than the mortality loss.

As shown in figure 9, dwarf mistletoe occurs on Douglas-fir and on western larch as witches' brooms and is readily detectable. In the pines, this disease is found on the branches or stem, occurring in plant form or causing local swelling on the main bole of the tree. Control of dwarf mistletoe is difficult and costly, but removal of infected trees during harvesting can reduce spread. The lack of a good small-log market in this area hampers the control of dwarf mistletoe.

Figure 9. — Heavy mistletoe infestation, such as on the Douglas-fir in the center, is the cause of reduced growth and in severe cases, death.

THE FOREST INDUSTRY

The forest industry consists mainly of sawmills, with little diversification

Beginning with its dependence upon the demand for box shook, the forest industry in central Washington has been primarily oriented to sawn products. This is due in part to the type of products made from ponderosa pine and the true firs. However, the inability to compete in markets for other products such as plywood and pulp has also restricted the industry. Factors contributing to this situation are: (1) the competitive edge of the western Washington industry in relation to availability and quality of transportation systems, (2) the wide geographic distribution of the timber in central Washington, causing processing plants to incur high transportation costs for their raw materials, and (3) lower quality and lack of concentrated volumes of species suited for plywood production.

Until 1958, only sawmills operated in central Washington. Since then, two plywood plants and two container board (pressed pulp) plants have begun operation in the southern half of the area. The installation of these facilities may be a signal of increased demand and decreasing supply or both in western Washington. More recently, a few firms have installed small-log processing equipment, and several chipping saw units have been set up close to woods operations.

Periodically, interest in a pulpmill on the Columbia River near Wenatchee flares up. To date, no firm plans have been made, with concentrated wood supply and financial considerations appearing to be major problems. Although no pulpmills exist in central Washington, approximately 90 percent of the coarse residues developed by sawmills are shipped to pulp and paper operations in other areas (Bergvall and Holtcamp 1971).

Eight sawmills process 60 percent of the total log consumption

In 1968, about 370 million board feet (Scribner), 60 percent of the total log consumption for central Washington, was processed by eight large sawmills (80,000 or more board feet per 8-hour shift). Similar figures for 1970 indicate the proportion of logs consumed by these mills has increased to 71 percent. This increase reflects the character of the industry, with many of the smaller sawmills shutting down operation during periods of depressed prices.

In 1968, these larger mills operated an average of almost two 8-hour shifts per day. This is indicated by a 1968 study (Bergvall and Gedney 1970) which shows mills in this class operated at 197 percent of their annual capacity, based on one 8-hour shift per day. Although the large mills processed a larger proportion of the total log consumption in 1970 than 1968, their consumption dropped to 155 percent of annual 8-hour shift capacity.

The number of sawmills has decreased sharply since 1947

As table 3 shows, the number of sawmills operating in central Washington has decreased 82 percent since 1947. This decline, characteristic of the Pacific Northwest as a whole, has been due to the smaller and less efficient mills going out of business and to consolidation of operations by larger companies.

The decrease in sawmills between 1968 and 1970 attests to the contracted business conditions and depressed lumber markets. Al-

Table 3. — Number of sawmills in central Washington by county, for selected years

Year	Total	Chelan	Grant	Kittitas	Klickitat	Okanogan	Yakima
1925	70	10	5	8	21	22	4
1947	118	12	20	14	37	27	8
1963	31	4	1	4	7	10	5
1968	29	4	1	3	6	12	3
1970	21	3	1	2	6	6	3

though many mills were not operating in 1970, a change in economic conditions comparable with those of the middle 1960's would revive some of them. The "in-business today, out-tomorrow" tendency is characteristic of the small sawmill segment of the industry in the Pacific Northwest.

Log harvest by county has shifted since 1925

Much of the early log harvest in central Washington came from private lands. It is for this reason that Chelan, Kittitas, and Klickitat Counties, with a combined total of 70 percent of the private land in central Washington, contributed over 82 percent of the 1925 log harvest. Klickitat County reached a peak log production in 1953 when 146 million board feet was harvested. Since then, the annual harvest has declined to about 75 million board feet. Interestingly, Klickitat County was the only county in central Washington to show no increase in log production in response to the lumber price increases of the late 1960's. Kittitas County has shown a general upward trend in log harvest since 1950, reflecting the greater access to the private lands in the western portion of the county.

Yakima County has experienced the most dramatic change in log production. In 1925, Yakima County accounted for only 1 percent of the central Washington log harvest. Even in 1936, logging was virtually nonexistent in the county, and sawmills were heavily dependent on timber from adjoining counties. Since the public sawtimber was mainly in the nonroaded higher elevations, log production was primarily from private lands. As sawtimber volume on private lands decreased, roads were built, unlocking the virgin stands on public lands and increasing their contribution to the county log production. By 1969, log production had reached 250 million board feet, about 37 percent of the total. This increase in cut occurred mainly on National Forest and Indian lands, which accounted for over 90 percent of the 1925-69 increase in log production for the county. With over 97 percent of the current sawtimber volume on publicly managed lands, most of the future cut will come from these lands.

Okanogan County has contributed heavily to the central Washington log harvest, with a general upward trend through 1968. As was the case in Yakima County, this trend reflects a large old-growth timber resource and increased accessibility. With 94 percent of the sawtimber volume on publicly managed lands, the trend in log production will be controlled by public policies. For the National Forests, particularly, the greatest factor may be the land use decisions associated with the recreation potential of much of the land along the Cascade Range.

In 1969, Okanogan and Yakima Counties accounted for almost 62 percent of the central Washington log harvest. With almost 60 percent of the remaining old-growth volume, these counties should continue to lead central Washington in log production.

The log harvest in Chelan-Douglas Counties has increased steadily since 1950—from 50 million board feet annually to about 90 million board feet in 1969.

Small-log utilization has been historically low

In an area such as central Washington with extensive acreage of overstocked poletimber stands, potential yields will not be realized without thinning programs. However, commercial thinning programs are hampered by a lack of a small-log market in the area. This is reflected by the fact that in 1968 only 5 percent of the logs consumed in sawmills were from trees less than 100 years old (Bergvall and Gedney 1970).

The primary factors that have contributed to the poor utilization of small logs in central Washington are: (1) overall supply of old-growth timber has been adequate for past and current demands, (2) small logs produce poorer quality material, thus hampering their use for products such as millwork, (3) the industry is geared to cut large logs and cannot handle small logs efficiently, and (4) high transportation costs for long hauling distances greatly reduce the returns to conversion of small logs. These factors, in addition to the little diversification and competition in the industry, have severely hampered the opportunities for intensive forest management in this area.

This condition will change over time as the old-growth timber is cut and the sawmills gear their operations to handle small logs. Additionally, increasing competition for timber in western Washington probably will result in increased demand for east-side supplies which may provide an outlet for some of the smaller logs.

Since the 1968 mill study, a few mills have installed small-log processing equipment to handle the increasing number of smaller logs they are receiving. An expansion of this trend toward increased utilization of small logs would promote the intensive management practices needed for many areas in central Washington.

The outlook for the industry is for increasing dependency on public timber and a smaller commercial forest land base

With the exception of periods of depressed prices, such as during 1969-70, the trend in log consumption has generally been upward. This trend has been buoyed by increased harvest of overmature stands on publicly managed lands. With 84 percent of the sawtimber volume, these lands should contribute an increasingly larger share of the log harvest.

Important to the forest industry is the supply of ponderosa pine sawtimber. Although log production in central Washington amounts to only 10 percent of the State's total, 73 percent of the ponderosa pine consumed in Washington came from this area (State of Washington 1961-68). The demand for pine products remains strong and will continue to exert pressure on the supply. However, the imbalance of cut to growth for ponderosa pine and the decreasing supply of high quality trees will soon result in a reduction of both quantity and quality.

The major question at this time is the impact of changing recreational and environmental values on the timber inventory. This part of Washington is recognized as having a particularly high potential for recreation, and pressures to remove areas from cutting are increasing. As the public agencies, particularly the National Forests, modify land use decisions to meet increasing recreational needs, the commercial forest land base and available timber volume will decrease. The result will be diminished allowable cuts and reduced volume of logs harvested from the area. Although the land use decisions are presently fluctuating, it appears that recreational usage will have an increasing impact on the forest resource and forest industry of central Washington, either through setting aside of forest land or through modification of management practices.

RECREATION — A GROWING IMPACT

Beyond supplying the raw material base for the forest industry, the forests of central Washington provide many additional benefits. Three of the most important uses are (1) water for urban and agricultural needs, (2) wildlife habitat and range for livestock, and (3) outlets for recreational pursuits. It is this last use that has become increasingly important in the land use decisions of the forest owners in central Washington.

From Mount Adams north, the Cascade Range displays rugged beauty; the northern part of this mountain range has been referred to as the "American Alps" (fig. 10). In addition to spectacular scenery, this area offers opportunity for almost every form of recreation.

Beginning in 1935, the natural beauty of this area was formally recognized by the establishment of the 801,000-acre North Cascades Primitive Area (part of which was on the west side of the Cascades). In 1960, the 458,000-acre Glacier Peak Wilderness was established. In 1968, culminating long and controversial debate, Congress created the North Cascades National Park, Ross Lake and Lake Chelan National Recreation Areas, and the Pasayten Wilderness Area, and added

Figure 10. — This part of the Cascade Range contains what has been described as the most beautiful and spectacular mountain scenery in the continental United States. Glacier Peak is in the background.

10,000 acres to the Glacier Peak Wilderness Area. In all, some 1,644,000 acres have been set aside in some degree of reserved status. Of this total, about 767,000 acres are in the central Washington unit. The impact on commercial forest land in central Washington was minor. Most of this area had been previously classified as reserved, as part of the Primitive Area set aside in 1935. Of the 767,000 acres, about 141,000 acres were transferred to the National Park Administration, with the remainder staying under U.S. Forest Service jurisdiction.

In addition, special management units have been proposed on National Forest land along the perimeter of the Park and Wilderness areas (see fig. 11). These areas cover about 428,000 acres in the central Washington area. The areas are proposed as scenic or roadless units according to their pristine condition, recreational amenities, and freedom from roads. Land within these special management units is rugged, with about 59 percent of the total area classified as unproductive from a timber management standpoint. Land capable of producing commercial timber comprises about 21 percent of the area, occurring mainly in the lower river drainages and along the perimeters. An additional 20 percent is classified as nonforest, exemplified by talus slopes, alpine meadows, and rocky peaks. Very little timber cutting is prescribed in these units. The North Cascades Land Use Plan, now being prepared by the U.S. Forest Service, indicates that approximately 800 million board feet of timber lies within these scenic and roadless units in central Washington. The plan currently calls for annual salvage of 1.9 million board feet of dead and high-risk trees in the scenic units only.

With almost 3.7 million acres in the central Washington area, most of which lie along the Cascades, the National Forests manage a vast area of prime recreational potential (fig. 12). All types of recreational use of the National Forests have been increasing rapidly, but recent Forest Service statistics show more than 40 percent of visitation is oriented to camping and backpacking.

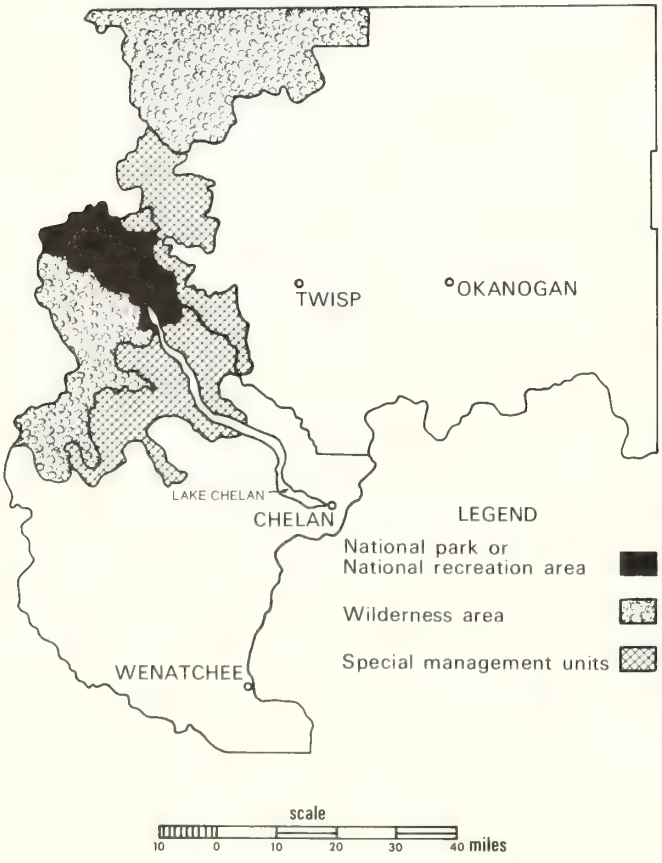

Figure 11. — North Cascades recreation complex — central Washington portion.

Figure 12. — Recreational opportunities abound in the forests of central Washington.

From 1950 to 1964, the number of visitor days of recreation usage on the National Forests of central Washington nearly doubled. From 1966 to 1969, the number of visitor days increased from 4 million to 6.2 million, or 55 percent. The creation of the North Cascades National Park and National Recreation areas, with the recently opened North Cascades highway, will increase the recreation potential tremendously. The Park Service predicted a visitation rate of 1 million annually for the new park in 1972 (National Park Service 1971). The Bonneville Power Administration predicts a fourfold increase over the 1960 level in forest-related recreational participation by the year 2000 (Katz 1967).

With the rapidly increasing population of the Puget Sound area demanding more facilities for recreation, it seems natural that the forest lands of central Washington will be expected to supply a large share.

Recognizing the need to protect the natural beauty of the North Cascades, the Forest Service has initiated a protective management system of scenic areas in addition to the wilderness system and special management units. Zones, known as Visual Resource Zones (VRZ), are set up to protect the natural landscape and esthetic appearance of forest land along or adjacent to travel routes, rivers, recreation sites, and scenic areas. This category presently covers approximately 623,000 acres of commercial forest land in central Washington. The sawtimber volume on these areas is approximately 8.5 billion board feet, about one-third of the total volume under National Forest management. Logging takes place on most of these areas, but special care is taken to maintain the natural scenic beauty. In the areas adjacent to recreation sites or major travel routes, the harvest is modified by extending the allowable cut over longer rotation periods, by using special technology, or by not cutting. In the background areas, timber management practices are designed to blend with the natural settings.

As table 4 shows, about 50 percent of the total National Forest area is classified as commercial forest land, with about one-third of this in Visual Resource Zones. Some of this land will have reduced yields due to modifications of harvesting and other management practices.

Land development for recreational purposes is increasing rapidly in the central Washington area, as is the case in most of the Northwest. Land is being purchased in large blocks, then subdivided for resale. In Klickitat County, for example, about 21,500 acres were purchased in 1969 for development (Olsen 1970). Most of this land has been subdivided into vacation home sites of 1 to 5 acres, effectively removing them from timber production.

Table 4. — Land classification[1] on National Forests of central Washington

National Forest	Total area	Commercial forest land			Noncommercial and nonforest land	Land in reserved status
		Standard[2]	Special[3]	Total		
	Thousand acres					
Okanogan	1,498	450	316	766	334	398
Wenatchee	1,609	544	235	779	423	407
Snoqualmie	521	227	57	284	101	136
Gifford Pinchot	67	23	15	38	5	24
All Forests	3,695	1,244	623	1,867	863	965

[1] *Based on management plans for each Forest.*

[2] *Areas where timber management is the primary consideration.*

[3] *Areas such as Visual Resource Zones, where management for values other than timber dictates modification of timber management practices.*

Some areas have been plagued with water, sewage, and pollution problems, which indicates the need for better planning or zoning. Areas of high-intensity development, such as Snoqualmie Pass, show the impact of concentrated development in relatively small areas. In such areas, intermingled public land may prove valuable as a buffer against overdevelopment and damage to the environment. Many private forest landowners are facing pressure to sell land, as escalating recreational land values tend to make timber management a second-best alternative.

Land development is creating problems for the Forest Service, particularly in western Kittitas and western Chelan Counties. Here, National Forest land alternates with blocks of private land as a result of the old railroad grants (fig. 4). Much of this area has prime recreational and scenic values, as well as the potential for higher than average volumes and yields for timber management. In these areas, the Forest Service has problems in coordinating land management to meet multiple goals of recreational usage and timber production, since timber management or recreational development on the private lands may not fit into the environmental plans of the Forest Service. Some land trades have occurred in areas adjacent to high-intensity recreation sites to allow the Forest Service to manage effectively the recreational potential.

Recreational pressure on the forests of central Washington is certain to increase rapidly. Recreation is becoming a big business and many communities are intensifying their pursuit of the recreational dollar. Leavenworth, in Chelan County, has completely remodeled the city center to resemble a Bavarian town (fig. 13). The town of Chelan is actively seeking a new ski development. The communities in the Methow River Valley are preparing for the increased tourism stemming from the completion of the North Cascades highway. Thus, it appears that many communities are striving to establish a larger recreational sector of their local economies. Along with this trend is pressure on the Forest Service to increase development of recreational facilities complementary to the towns' programs.

The North Cascades Land Use Plan is indicative of the Forest Service's policy of expansion of multiple opportunity recreation areas. With the acceptance of this plan almost certainly will come the demand to expand other areas with extensive scenic and recreational values such as Alpine Lakes or Cougar Lake. At the present time areas south and west of Wenatchee are being analyzed for inclusion in the Wilderness program.

Figure 13. — This Bavarian facade in Leavenworth in Chelan County is an example of how towns are attempting to attract tourist trade.

The increasing interest in forest-oriented recreation will carry with it a reduction in the amount of timber available for forest industries. On public lands, upcoming decisions concerning Wilderness Areas, such as the Alpine Lakes area, will have a very real effect on the allowable cut level. Similarly, on private lands, recreational development will reduce the timber-producing land base. Factors related to decisions bearing on the use of the forest resources of central Washington are important to the local economies of both timber and recreation, as well as the ability of the area to provide wood for the Nation while satisfying other human needs. Critical evaluation of benefits and costs involved in meeting local, regional, and national objectives requires a high level of planning and care in establishing priorities in land use.

Table 5.—Area by land class and county, central Washington, January 1, 1968

(In thousand acres)

Land class	All counties	Chelan-Douglas	Kittitas	Klickitat	Okanogan	Yakima	Grant	Benton
Forest land:								
Commercial	4,370	750	657	502	1,620	841	—	—
Productive reserved	402	106	14	1	203	78	—	—
Unproductive	1,231	462	100	52	447	170	—	—
Total	6,003	1,318	771	555	2,270	1,089	—	—
Nonforest land[1]	8,696	1,731	714	666	1,123	1,644	1,716	1,102
Total area[2]	14,699	3,049	1,485	1,221	3,393	2,733	1,716	1,102

[1] *Includes swampland, industrial and urban areas, other nonforest land, and 17,163 acres, classed as water by Forest Survey standards, but defined by the Bureau of the Census as land.*

[2] *Source: U.S. Bureau of the Census, Land and Water Area of the United States, 1960, revised 1965.*

Table 6.—Area of commercial forest land, by ownership class and county, central Washington, January 1, 1968

(In thousand acres)

Ownership class[1]	All counties	Chelan-Douglas	Kittitas	Klickitat	Okanogan	Yakima
Public:						
National Forest	1,867	552	267	9	766	273
Other Federal:						
Bureau of Land Management	19	5	—	2	12	—
Bureau of Indian Affairs	779	1	—	44	319	415
Miscellaneous Federal	27	11	9	2	4	1
Total other Federal	825	17	9	48	335	416
State	492	31	77	75	218	91
County and municipal	2	—	—	2	—	—
Total public	3,186	600	353	134	1,319	780
Private:						
Forest industry	433	65	108	193	28	39
Farmer-owned	311	10	6	69	216	10
Miscellaneous private	440	75	190	106	57	12
Total private	1,184	150	304	368	301	61
All ownerships	4,370	750	657	502	1,620	841

[1] *Estimates of commercial forest land in specific ownerships are derived by sampling methods. Consequently, they may not agree with the official estimates of the individual agencies.*

Table 7.—Area of commercial forest land, by stand-size and ownership classes, central Washington, January 1, 1968

(In thousand acres)

Stand-size class	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Sawtimber stands:					
Old-growth[1]	1,312	856	342	53	61
Young-growth[2]	1,584	485	548	273	278
Total sawtimber	2,896	1,341	890	326	339
Poletimber stands	809	403	211	50	145
Sapling and seedling stands	383	99	154	30	100
Nonstocked areas	282	24	64	27	167
Total, all classes	4,370	1,867	1,319	433	751

[1] *Stands 140 years and older.*

[2] *Stands less than 140 years old.*

Table 8.—Area of commercial forest land, by stand volume and ownership class, central Washington, January 1, 1968

(In thousand acres)

Stand volumes (board feet per acre[1])	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Less than 1,500	679	234	131	57	257
1,500 to 4,999	1,028	303	358	118	249
5,000 to 9,999	969	377	356	136	100
10,000 to 19,999	803	388	249	89	77
20,000 to 29,999	421	239	110	29	43
30,000 to 39,999	271	151	95	—	25
40,000 to 49,999	89	81	4	4	—
50,000 or more	110	94	16	—	—
Total	4,370	1,867	1,319	433	751

[1] *Net volume, International ¼-inch scale.*

Table 9.—Area of commercial forest land, by site and ownership classes, central Washington, January 1, 1968

(In thousand acres)

Site class[1] (cubic feet per acre)	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
225 or more	1	1	—	—	—
165 to 224	118	32	47	27	12
120 to 164	251	75	82	36	58
85 to 119	855	349	266	98	142
50 to 84	2,477	1,064	750	248	415
20 to 49	668	346	174	24	124
All classes	4,370	1,867	1,319	433	751

[1] *A classification in terms of capacity for cubic-foot annual growth per acre at culmination of mean annual growth in fully stocked stands.*

Table 10.—Area of commercial forest land, by forest type and ownership class, central Washington, January 1, 1968

(In thousand acres)

Forest type	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Douglas-fir	1,592	829	406	95	262
Pacific silver fir	98	59	17	4	18
Subalpine fir	87	45	39	3	—
Grand fir	263	99	81	55	28
Noble fir	2	2	—	—	—
Western larch	147	81	60	6	—
Ponderosa pine	1,195	361	505	202	127
Lodgepole pine	321	198	91	14	18
Western white pine	13	13	—	—	—
Whitebark pine	4	4	—	—	—
Engelmann spruce	101	62	25	4	10
Western redcedar	11	11	—	—	—
Alaska-cedar	1	1	—	—	—
Western hemlock	47	36	—	—	11
Mountain hemlock	43	30	7	—	6
Commercial hardwoods[1]	67	12	7	—	48
Noncommercial hardwoods	96	—	17	22	57
Nonstocked	282	24	64	28	166
Total	4,370	1,867	1,319	433	751

[1] *Includes red alder, bigleaf maple, quaking aspen, and black cottonwood forest types.*

Table 11.—Area of noncommercial forest land, by ownership class and forest type, central Washington, January 1, 1968

(In thousand acres)

Forest type	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
		RESERVED			
Productive:[1]					
Douglas-fir	50	50	(2)	—	—
Subalpine fir	23	23	—	—	—
Grand fir	12	12	—	—	—
Western larch	6	6	—	—	—
Ponderosa pine	12	11	1	—	—
Lodgepole pine	90	90	—	—	—
Spruce	179	179	—	—	—
Other conifers	30	30	—	—	—
Hardwoods	(2)	(2)	(2)	—	—
Total	402	401	1	—	—
Unproductive:					
Low site[3]	251	221	30	—	—
Noncommercial rocky	136	97	39	—	—
Other	—	—	—	—	—
Total	387	318	69	—	—
Total reserved	789	719	70	—	—
		UNRESERVED-UNPRODUCTIVE			
Low site:[3]					
Douglas-fir	2	—	—	—	2
Subalpine fir	4	—	—	4	—
Grand fir	—	—	—	—	—
Western larch	—	—	—	—	—
Ponderosa pine	19	—	19	—	—
Lodgepole pine	—	—	—	—	—
Spruce	6	—	6	—	—
Other conifers	1	—	1	—	—
Hardwoods	—	—	—	—	—
Unclassified	319	319	—	—	—
Total	351	319	26	4	2
Noncommercial rocky:[4]					
Douglas-fir	70	—	31	17	22
Subalpine fir	17	—	—	12	5
Grand fir	—	—	—	—	—
Western larch	7	—	7	—	—
Ponderosa pine	45	—	37	4	4
Lodgepole pine	—	—	—	—	—
Spruce	—	—	—	—	—
Other Conifers	4	—	1	3	—
Hardwoods	—	—	—	—	—
Unclassified	214	214	—	—	—
Total	357	214	76	36	31
Noncommercial hardwoods	74	2	25	3	44
Critical watershed[5]	10	10	—	—	—
Adverse location[5]	52	52	—	—	—
Total unreserved	844	597	127	43	77

[1] *Includes forest land capable of growing 20 cubic feet or more per acre per year in the North Cascades National Park; Lake Chelan National Recreation Area; Glacier Peak, Pasayten, and Alpine Lakes Wilderness Areas; several natural areas; and several State and county parks.*

[2] *Less than 500 acres.*

[3] *Areas stocked with commercial tree species but incapable of growing 20 cubic feet per acre because of soil and climatic factors; primarily found in the mountains at the upper limits of tree growth (timberline).*

[4] *Includes areas that are capable of growing merchantable trees but are too steep and rocky for timber management.*

[5] *Includes unstable areas that cannot be logged without seriously affecting the watershed and small isolated patches of commercial forest land on steep mountainsides.*

Table 12.—Average number of growing-stock trees per acre on commercial forest land by diameter and ownership classes, central Washington, January 1, 1968

Diameter class (inches at at breast height)	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
5.0-6.9	46.1	55.5	45.3	27.8	34.9
7.0-8.9	29.8	35.5	28.1	26.0	20.5
9.0-10.9	17.3	20.9	15.6	14.9	12.6
11.0-12.9	10.7	12.0	10.7	8.7	8.8
13.0-14.9	7.2	8.5	6.5	7.2	5.4
15.0-16.9	5.1	6.1	4.7	4.1	4.1
17.0-18.9	3.6	4.5	3.1	3.3	2.3
19.0-20.9	2.5	3.3	2.2	1.6	1.6
21.0-28.9	5.0	6.7	4.5	3.6	2.3
29.0-38.9	1.6	2.2	1.7	.9	.6
39.0 and larger	.4	.4	.4	.2	.1
Total	129.3	155.6	122.8	98.3	93.2

Table 13. — Number of growing-stock trees on commercial forest land by species and diameter class, central Washington, January 1, 1968

(Thousand trees)

Species	Diameter class (inches at breast height)											
	All classes	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:												
Douglas-fir	165,718	51,654	35,991	22,274	14,592	11,088	7,881	5,742	3,952	8,730	3,004	810
Pacific silver fir	20,758	7,100	3,814	2,182	2,011	1,400	1,192	970	596	1,201	256	36
Subalpine fir	36,744	14,348	9,097	5,186	3,317	2,167	1,141	693	344	403	48	—
Grand fir	56,968	23,993	12,517	6,933	4,647	3,067	2,106	1,172	806	1,226	440	61
Noble fir	416	134	76	12	19	72	9	15	20	33	22	4
Western larch	25,069	6,324	5,076	3,948	2,320	1,957	1,411	923	814	1,726	448	122
Ponderosa pine	99,790	30,827	22,426	13,855	8,770	5,678	4,350	3,426	2,509	5,483	2,098	368
Lodgepole pine	98,224	47,613	27,548	12,518	5,651	2,395	1,274	599	363	248	18	-
Western white pine	5,975	1,816	1,093	984	603	479	337	200	167	221	69	6
Whitebark pine	2,751	1,230	502	426	222	198	77	43	9	40	4	-
Engelmann spruce	22,406	6,947	4,859	3,686	2,253	1,430	1,040	708	473	781	212	17
Western redcedar	2,160	668	459	195	131	103	112	92	71	180	105	44
Alaska-cedar	1,242	325	210	229	93	52	51	70	38	133	39	2
Western hemlock	7,847	2,167	1,381	1,096	659	632	443	305	281	663	175	45
Mountain hemlock	8,689	1,836	1,502	948	946	776	861	502	360	748	178	32
Total softwoods	554,757	196,982	126,551	74,472	46,234	31,494	22,285	15,460	10,803	21,813	7,116	1,547
Hardwoods[1]	10,269	4,494	3,536	1,064	719	184	71	86	38	37	40	—
All species	565,026	201,476	130,087	75,536	46,953	31,678	22,356	15,546	10,841	21,850	7,156	1,547

[1] *Primarily black cottonwood, quaking aspen, Oregon white oak; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 14. — Area of commercial forest land and volume of growing stock and sawtimber by stand-age and ownership classes, central Washington, January 1, 1968

Stand age (years)	All ownerships			National Forest			Other public			Forest industry			Farmer and miscellaneous private		
	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber	Thousand acres	Growing stock	Sawtimber
		Million cubic feet	*Million board feet*[1]		*Million cubic feet*	*Million board feet*[1]		*Million cubic feet*	*Million board feet*[1]		*Million cubic feet*	*Million board feet*[1]		*Million cubic feet*	*Million board feet*[1]
Nonstocked:[2]	282	50	245	24	([3])	4	63	16	72	28	5	19	167	29	150
0- 9	79	31	162	15	6	49	21	10	48	15	6	26	28	9	39
10- 19	70	35	156	30	9	36	24	21	107	—	—	—	16	5	13
20- 29	53	19	40	20	8	28	—	—	—	—	—	—	33	11	12
30- 39	152	113	227	48	26	53	43	44	106	29	17	53	32	26	15
40- 49	209	236	738	70	75	184	58	74	282	34	31	77	47	56	195
50- 59	209	353	971	73	106	283	75	140	367	19	27	64	42	80	257
60- 69	282	565	1,635	116	234	638	83	204	548	37	59	195	46	68	254
70- 79	191	440	1,406	99	244	728	37	76	266	18	24	102	37	96	310
80- 89	86	214	691	86	214	691	—	—	—	—	—	—	—	—	—
90- 99	80	203	611	58	170	535	13	27	48	—	—	—	9	6	28
100-109	106	319	1,364	86	280	1,156	4	3	14	—	—	—	16	36	194
110-119	83	276	1,223	66	208	868	10	23	104	—	—	—	7	45	251
120-129	67	196	924	60	187	866	—	—	—	7	9	58	—	—	—
130-159	207	675	3,311	191	641	3,140	16	34	171	—	—	—	—	—	—
160-199	176	663	3,606	172	631	3,423	—	—	—	4	32	183	—	—	—
Over 200	365	1,870	11,084	314	1,599	9,590	26	175	974	11	49	292	14	47	228
Uneven, under rotation age[2]	1,092	2,422	10,536	143	374	1,907	546	1,230	5,269	193	426	1,798	210	392	1,562
Uneven, over rotation age[2]	581	2,294	11,979	196	830	4,327	300	1,143	6,012	38	122	634	47	199	1,006
Total, all classes	4,370	10,974	50,909	1,867	5,842	28,506	1,319	3,220	14,388	433	807	3,501	751	1,105	4,514

[1] *International 1/4 inch rule*

[2] *See "Definition of Terms."*

[3] *Less than 500,000 cubic feet*

Table 15.—Volume of all growing stock and sawtimber on commercial forest land, by ownership class and by softwoods and hardwoods, central Washington, January 1, 1968

Ownership class	Average volume per acre	Total volume		
		All species	Softwoods	Hardwoods
	Cubic feet	*Million cubic feet*		
All growing stock:				
National Forest	3,129	5,842	5,827	15
Other public	2,441	3,220	3,213	7
Forest industry	1,864	807	805	2
Farmer and miscellaneous private	1,471	1,105	1,075	30
All ownerships	2,511	10,974	10,920	54
	Board feet	*Million board feet*		
Sawtimber (International ¼-inch rule):				
National Forest	15,268	28,506	28,451	55
Other public	10,908	14,388	14,365	23
Forest industry	8,085	3,501	3,496	5
Farmer and miscellaneous private	6,011	4,514	4,475	39
All ownerships	11,650	50,909	50,787	122
Sawtimber (Scribner rule):				
National Forest	13,569	25,333	25,279	54
Other public	9,572	12,626	12,603	23
Forest industry	6,975	3,020	3,015	5
Farmer and miscellaneous private	5,124	3,848	3,811	37
All ownerships	10,258	44,827	44,708	119

Table 16.—Volume of all growing stock and sawtimber on commercial forest land by county and ownership class, central Washington, January 1, 1968

County	Total	National Forest	Other public	Forest industry	Farmer miscellaneous private
			Million cubic feet		
Growing stock:					
Chelan-Douglas	2,124	1,713	118	179	114
Kittitas	2,102	1,168	142	234	558
Klickitat	883	74	332	278	199
Okanogan	2,826	1,680	906	22	218
Yakima	3,039	1,207	1,722	94	16
Total	10,974	5,842	3,220	807	1,105
			Million board feet		
Sawtimber (International ¼-inch rule):					
Chelan-Douglas	9,783	7,975	502	839	467
Kittitas	10,128	6,080	519	1,022	2,507
Klickitat	4,124	474	1,652	1,187	811
Okanogan	11,991	7,502	3,705	92	692
Yakima	14,883	6,475	8,010	361	37
Total	50,909	28,506	14,388	3,501	4,514
Sawtimber (Scribner rule):					
Chelan-Douglas	8,838	7,293	421	729	395
Kittitas	8,992	5,503	445	887	2,157
Klickitat	3,518	375	1,457	1,011	675
Okanogan	10,402	6,539	3,194	81	588
Yakima	13,077	5,623	7,109	312	33
Total	44,827	25,333	12,626	3,020	3,848

Table 17. — Volume of timber on commercial forest land, by class of timber and by softwoods and hardwoods, central Washington, January 1, 1968

(In million cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Saw-log portion	8,124	8,108	16
Upper-stem portion	472	463	9
Total	8,596	8,571	25
Poletimber trees	2,378	2,349	29
All growing-stock trees	10,974	10,920	54
Sound cull trees	103	38	65
Rotten cull trees	76	71	5
Salvable dead sawtimber trees	295	295	(1)
Total, all timber	11,448	11,324	124

[1] *Less than 500,000 cubic feet.*

Table 18. — Volume of growing stock and sawtimber on commercial forest land, by stand-size class and by softwoods and hardwoods, central Washington, January 1, 1968

Stand-size class	Average volume per acre	Total volume		
		All species	Softwoods	Hardwoods
	Cubic feet	*Million cubic feet*		
All growing stock:				
Sawtimber stands	3,259	9,437	9,410	27
Poletimber stands	1,543	1,248	1,224	24
Sapling and seedling stands	624	239	236	3
Nonstocked areas	177	50	50	—
Total	2,511	10,974	10,920	54
	Board feet	*Million board feet*		
Sawtimber (International ¼-inch rule):				
Sawtimber stands	16,443	47,620	47,527	93
Poletimber stands	2,697	2,182	2,162	20
Sapling and seedling stands	2,256	864	855	9
Nonstocked areas	862	243	243	—
Total	11,650	50,909	50,787	122
Sawtimber (Scribner rule):				
Sawtimber stands	14,505	42,008	41,917	91
Poletimber stands	2,295	1,857	1,837	20
Sapling and seedling stands	1,963	752	744	8
Nonstocked areas	745	210	210	—
Total	10,258	44,827	44,708	119

Table 19. —Volume of all growing stock on commercial forest land, by species and county, central Washington, January 1, 1968

(In million cubic feet)

Species	All counties	Chelan-Douglas	Kittitas	Klickitat	Okanogan	Yakima
Softwoods:						
Douglas-fir	3,864	744	845	426	1,226	623
Pacific silver fir	564	128	179	8	—	249
Subalpine fir	522	208	72	2	139	101
Grand fir	916	142	216	102	14	442
Noble fir	19	—	10	5	1	3
Western larch	659	31	121	1	304	202
Ponderosa pine	2,319	403	223	278	601	814
Lodgepole pine	799	202	98	51	240	208
Western white pine	136	51	39	1	—	45
Whitebark pine	27	8	—	—	9	10
Engelmann spruce	493	87	52	—	261	93
Western redcedar	66	27	24	8	1	6
Alaska-cedar	38	5	1	—	—	32
Western hemlock	239	45	142	—	—	52
Mountain hemlock	259	39	77	—	—	143
All softwoods	10,920	2,120	2,099	882	2,796	3,023
Hardwoods[1]	54	4	3	1	30	16
All species	10,974	2,124	2,102	883	2,826	3,039

[1] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 20.—Volume of sawtimber on commercial forest land, by species and county, central Washington, January 1, 1968 (International ¼-inch rule)

(In million board feet)

Species	All counties	Chelan-Douglas	Kittitas	Klickitat	Okanogan	Yakima
Softwoods:						
Douglas-fir	19,281	3,580	4,503	2,134	5,555	3,509
Pacific silver fir	2,911	625	953	49	—	1,284
Subalpine fir	1,555	654	178	5	358	360
Grand fir	3,824	572	772	449	24	2,007
Noble fir	114	1	59	36	2	16
Western larch	3,302	161	604	3	1,499	1,035
Ponderosa pine	11,971	2,393	1,101	1,209	3,185	4,083
Lodgepole pine	1,468	388	171	179	192	538
Western white pine	707	296	174	3	—	234
Whitebark pine	79	22	—	1	14	42
Engelmann spruce	2,241	420	234	—	1,093	494
Western redcedar	350	135	126	52	4	33
Alaska-cedar	202	30	6	—	3	163
Western hemlock	1,390	275	845	—	—	270
Mountain hemlock	1,392	225	391	—	1	775
Total softwoods	50,787	9,777	10,117	4,120	11,930	14,843
Hardwoods[1]	122	6	11	4	61	40
All species	50,909	9,783	10,128	4,124	11,991	14,883

[1] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 21.—Volume of sawtimber on commercial forest land, by species and county, central Washington, January 1, 1968 (Scribner rule)

(In million board feet)

Species	All counties	Chelan-Douglas	Kittitas	Klickitat	Okanogan	Yakima
Softwoods:						
Douglas-fir	17,224	3,277	4,118	1,824	4,755	3,250
Pacific silver fir	2,510	561	838	38	—	1,073
Subalpine fir	1,290	543	147	4	303	293
Grand fir	3,260	498	667	377	20	1,698
Noble fir	97	—	55	30	1	11
Western larch	2,885	139	529	3	1,313	901
Ponderosa pine	10,831	2,245	1,000	1,039	2,838	3,709
Lodgepole pine	1,196	319	142	150	155	430
Western white pine	608	258	147	2	—	201
Whitebark pine	67	17	—	1	12	37
Engelmann spruce	1,930	365	200	—	939	426
Western redcedar	314	122	114	47	3	28
Alaska-cedar	174	27	4	—	3	140
Western hemlock	1,024	206	623	—	—	195
Mountain hemlock	1,298	255	397	—	—	646
Total softwoods	44,708	8,832	8,981	3,515	10,342	13,038
Hardwoods[1]	119	6	11	3	60	39
All species	44,827	8,838	8,992	3,518	10,402	13,077

[1] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 22.—Volume of growing stock on commercial forest land by species and ownership class, central Washington, January 1, 1968

(In million cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	3,864	2,218	861	292	493
Pacific silver fir	564	413	98	14	39
Subalpine fir	522	362	136	12	12
Grand fir	916	377	322	108	109
Noble fir	19	18	—	—	1
Western larch	659	288	315	13	43
Ponderosa pine	2,319	779	1,008	297	235
Lodgepole pine	799	508	238	22	31
Western white pine	136	104	10	12	10
Whitebark pine	27	17	7	3	—
Engelmann spruce	493	307	129	28	29
Western redcedar	66	45	10	3	8
Alaska-cedar	38	20	13	—	5
Western hemlock	239	201	7	1	30
Mountain hemlock	259	170	59	—	30
Total softwoods	10,920	5,827	3,213	805	1,075
Hardwoods[1]	54	15	7	2	30
All species	10,974	5,842	3,220	807	1,105

[1] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 23.—Net volume of sawtimber on commercial forest land by species and ownership class, central Washington, January 1, 1968 (International ¼-inch rule)

(In million board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	19,281	11,691	4,076	1,371	2,143
Pacific silver fir	2,911	2,180	444	81	206
Subalpine fir	1,555	998	457	51	49
Grand fir	3,824	1,505	1,426	448	445
Noble fir	114	108	—	—	6
Western larch	3,302	1,662	1,441	36	163
Ponderosa pine	11,971	4,882	4,840	1,280	969
Lodgepole pine	1,468	867	551	40	10
Western white pine	707	569	50	42	46
Whitebark pine	79	52	23	4	—
Engelmann spruce	2,241	1,431	594	133	83
Western redcedar	350	248	57	7	38
Alaska-cedar	202	103	70	—	29
Western hemlock	1,390	1,209	33	3	145
Mountain hemlock	1,392	946	303	—	143
Total softwoods	50,787	28,451	14,365	3,496	4,475
Hardwoods[1]	122	55	23	5	39
All species	50,909	28,506	14,388	3,501	4,514

[1] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 24.—Net volume of sawtimber on commercial forest land by species and ownership class, central Washington, January 1, 1968 (Scribner rule)

(In million board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	17,224	10,626	3,601	1,183	1,814
Pacific silver fir	2,510	1,879	384	72	175
Subalpine fir	1,290	829	377	44	40
Grand fir	3,260	1,246	1,256	381	377
Noble fir	97	92	—	—	5
Western larch	2,885	1,468	1,248	29	140
Ponderosa pine	10,831	4,598	4,288	1,112	833
Lodgepole pine	1,196	694	461	32	9
Western white pine	608	491	45	34	38
Whitebark pine	67	44	20	3	—
Engelmann spruce	1,930	1,232	512	116	70
Western redcedar	314	222	52	6	34
Alaska-cedar	174	85	63	—	26
Western hemlock	1,024	863	30	3	128
Mountain hemlock	1,298	910	266	—	122
Total softwoods	44,708	25,279	12,603	3,015	3,811
Hardwoods[1]	119	54	23	5	37
All species	44,827	25,333	12,626	3,020	3,848

[1] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 25. — Volume of growing stock on commercial forest land, by species and diameter class, central Washington, January 1, 1968

(In million cubic feet)

Species	Diameter class (inches at breast height)											
	All classes	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:												
Douglas-fir	3,862	147	231	260	272	304	299	290	254	890	595	320
Pacific silver fir	564	24	28	30	43	46	57	60	48	151	61	16
Subalpine fir	523	60	71	72	75	69	50	42	27	47	10	—
Grand fir	916	74	85	86	95	93	91	68	59	143	96	26
Noble fir	19	1	—	—	—	2	1	1	2	4	6	2
Western larch	659	19	33	48	45	56	56	47	54	174	87	40
Ponderosa pine	2,320	83	126	144	148	142	156	164	160	591	452	154
Lodgepole pine	799	165	199	157	104	63	45	25	20	19	2	—
Western white pine	136	5	8	13	12	14	15	12	13	25	17	2
Whitebark pine	27	3	3	4	3	5	4	2	—	2	1	—
Engelmann spruce	493	26	37	50	51	47	47	43	36	101	48	7
Western redcedar	66	2	2	1	1	4	4	4	4	16	15	13
Alaska-cedar	38	1	2	2	2	2	1	4	2	14	7	1
Western hemlock	239	5	7	13	14	19	18	18	20	75	33	17
Mountain hemlock	259	4	7	11	16	20	32	27	24	74	34	10
Total softwoods	10,920	619	839	891	881	886	876	807	723	2,326	1,464	608
Hardwoods[1]	54	9	13	7	9	3	2	3	1	3	4	—
All species	10,974	628	852	898	890	889	878	810	724	2,329	1,468	608

[1] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder*

Table 26. — Volume of sawtimber on commercial forest land, by species and diameter class, central Washington, January 1, 1968 (International 1/4-inch rule)

(In million board feet)

Species	Diameter class (inches at breast height)								
	All classes	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:									
Douglas-fir	19,281	1,159	1,452	1,563	1,624	1,512	5,700	4,084	2,187
Pacific silver fir	2,911	210	244	320	359	300	956	409	113
Subalpine fir	1,555	306	320	244	214	146	264	61	—
Grand fir	3,824	446	483	486	383	339	878	629	180
Noble fir	114	2	13	3	6	9	31	39	11
Western larch	3,302	190	286	314	299	337	1,105	527	244
Ponderosa pine	11,971	720	725	843	931	934	3,718	3,041	1,059
Lodgepole pine	1,468	497	346	254	145	115	98	13	—
Western white pine	707	68	79	88	74	83	171	126	18
Whitebark pine	79	15	23	13	8	3	15	2	—
Engelmann spruce	2,241	246	235	253	239	217	653	342	56
Western redcedar	350	7	11	21	22	22	91	98	78
Alaska-cedar	202	8	7	9	21	13	91	49	4
Western hemlock	1,390	71	105	108	111	127	505	238	125
Mountain hemlock	1,392	82	103	170	141	133	461	226	76
Total softwoods	50,787	4,027	4,432	4,689	4,577	4,290	14,737	9,884	4,151
Hardwoods[1]	122	35	13	9	14	8	16	27	—
All species	50,909	4,062	4,445	4,698	4,591	4,298	14,753	9,011	4,151

[1] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 27. — Volume of sawtimber on commercial forest land, by species and diameter class, central Washington, January 1, 1968 (Scribner rule)

(In million board feet)

Species	Diameter class (inches at breast height)								
	All species	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-28.9	29.0-38.9	39.0 and larger
Softwoods:									
Douglas-fir	17,224	905	1,181	1,306	1,386	1,315	5,120	3,838	2,173
Pacific silver fir	2,510	164	193	259	295	254	838	384	123
Subalpine fir	1,290	230	251	204	184	127	237	57	—
Grand fir	3,260	333	383	400	317	290	782	596	159
Noble fir	97	1	7	2	5	7	26	39	10
Western larch	2,885	138	215	251	248	287	1,001	507	238
Ponderosa pine	10,831	504	567	707	824	845	3,513	2,888	983
Lodgepole pine	1,196	385	275	207	124	101	90	14	—
Western white pine	608	50	63	75	64	75	154	111	16
Whitebark pine	67	9	18	12	7	3	15	3	—
Engelmann spruce	1,930	182	196	217	209	193	582	303	48
Western redcedar	314	6	9	16	18	17	79	90	79
Alaska-cedar	174	5	4	9	18	12	79	44	3
Western hemlock	1,024	51	69	71	71	88	358	204	112
Mountain hemlock	1,298	66	92	152	130	124	442	224	68
Total softwoods	44,708	3,029	3,523	3,888	3,900	3,738	13,316	9,302	4,012
Hardwoods[1]	119	35	13	7	11	9	16	28	—
All species	44,827	3,064	3,536	3,895	3,911	3,747	13,332	9,330	4,012

[1]*Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 28.—Net annual growth of growing stock on commercial forest land, by species and ownership class, central Washington, January 1, 1968[1]

(In thousand cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	45,700	20,700	9,000	5,700	10,300
True firs	31,300	14,900	10,200	3,100	3,100
Western larch	-3,400[2]	-300[2]	-2,400[2]	100	-800[2]
Ponderosa pine	27,800	5,800	12,900	4,300	4,800
Lodgepole pine	8,600	5,900	2,000	-300[2]	1,000
Other pines	200	500	—	200	-500[2]
Engelmann spruce	5,900	3,200	2,400	-100[2]	400
Cedars	1,000	700	200	100	—
Hemlock	3,200	2,500	400	—	300
Total softwoods	120,300	53,900	34,700	13,100	18,600
Hardwoods[3]	1,100	300	—	—	800
All species	121,400	54,200	34,700	13,100	19,400

[1] *See "Inventory Procedures" for an explanation of growth estimates and the actual periods over which growth was measured.*

[2] *Negative growth is the result of annual mortality exceeding gross annual growth.*

[3] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 29.—Net annual growth of sawtimber on commercial forest land, by species and ownership class, central Washington, January 1, 1968[1] *(International ¼-inch rule)*

(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	226,900	100,800	36,100	27,600	62,400
True firs	137,400	58,700	49,800	13,700	15,200
Western larch	-24,800[2]	-4,000[2]	-18,400[2]	2,900	-5,300[2]
Ponderosa pine	151,600	35,600	68,100	22,600	25,300
Lodgepole pine	23,400	16,800	5,000	-400[2]	2,000
Other pines	3,200	2,700	2,800	700	-3,000[2]
Engelmann spruce	36,400	15,200	22,000	-2,500[2]	1,700
Cedars	5,300	4,000	800	200	300
Hemlock	15,500	12,600	1,500	—	1,400
Total softwoods	574,900	242,400	167,700	64,800	100,000
Hardwoods[3]	2,600	1,900	500	—	200
All species	577,500	244,300	168,200	64,800	100,200

[1] *See "Inventory Procedures" for an explanation of growth estimates and the actual periods over which growth was measured.*

[2] *Negative growth is the result of annual mortality exceeding gross annual growth.*

[3] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 30.—Net annual growth of sawtimber on commercial forest land, by species and ownership class, central Washington, January 1, 1968[1] (Scribner rule)

(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	196,400	94,100	29,400	23,200	49,700
True firs	118,000	50,200	42,700	12,100	13,000
Western larch	-21,000[2]	-3,000[2]	-14,900[2]	1,800	-4,900[2]
Ponderosa pine	129,100	32,900	58,100	17,900	20,200
Lodgepole pine	18,600	13,500	3,900	-400[2]	1,600
Other pines	3,000	2,700	2,200	700	-2,600[2]
Engelmann spruce	30,500	13,400	17,900	-2,300[2]	1,500
Cedars	5,100	3,800	700	300	300
Hemlock	13,400	10,600	1,400	—	1,400
Total softwoods	493,100	218,200	141,400	53,300	80,200
Hardwoods[3]	2,500	1,800	400	—	300
All species	495,600	220,000	141,800	53,300	80,500

[1] *See "Inventory Procedures" for an explanation of growth estimates and the actual periods over which growth was measured.*

[2] *Negative growth is the result of annual mortality exceeding gross annual growth.*

[3] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 31.—Net annual growth of all growing stock on commercial forest land, by species and county, central Washington, January 1, 1968[1]

(In thousand cubic feet)

Species	All counties	Chelan-Douglas	Kittitas	Klickitat	Okanogan	Yakima
Softwoods:						
Douglas-fir	45,700	10,300	9,300	6,200	15,900	4,000
True firs	31,300	5,300	6,300	3,100	2,200	14,400
Western larch	-3,400[2]	100	500	—	-900[2]	-3,100[2]
Ponderosa pine	27,800	4,200	1,800	4,800	8,800	8,200
Lodgepole pine	8,600	300	1,000	1,200	4,200	1,900
Other pines	200	200	-500[2]	—	100	400
Engelmann spruce	5,900	500	900	—	3,600	900
Cedars	1,000	400	300	100	—	200
Hemlock	3,200	1,000	1,100	-200[2]	—	1,300
Total softwoods	120,300	22,300	20,700	15,200	33,900	28,200
Hardwoods[3]	1,100	-100[2]	100	100	400	600
All species	121,400	22,200	20,800	15,300	34,300	28,800

[1] *See "Inventory Procedures" for an explanation of growth estimates and the actual periods over which growth was measured.*

[2] *Negative growth is the result of annual mortality exceeding annual gross growth.*

[3] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 32.—Net annual growth of sawtimber on commercial forest land, by species and county, central Washington, January 1, 1968[1] (International ¼-inch rule)

(In thousand board feet)

Species	All counties	Chelan-Douglas	Kittitas	Klickitat	Okanogan	Yakima
Softwoods:						
Douglas-fir	226,900	45,400	56,800	36,400	67,500	20,800
True firs	137,400	21,200	26,500	14,600	7,000	68,100
Western larch	-24,800[2]	-200[2]	1,300	—	-4,700[2]	-21,200[2]
Ponderosa pine	151,600	25,100	10,500	35,700	31,200	49,100
Lodgepole pine	23,400	1,900	2,000	1,400	7,400	10,700
Other pines	3,200	1,000	-3,100[2]	—	300	5,000
Engelmann spruce	36,400	300	3,100	—	32,000	1,000
Cedars	5,300	2,100	1,300	400	100	1,400
Hemlock	15,500	5,100	6,100	-1,000[2]	—	5,300
Total softwoods	574,900	101,900	104,500	87,500	140,800	140,200
Hardwoods[3]	2,600	—	200	—	1,600	800
All species	577,500	101,900	104,700	87,500	142,400	141,000

[1] *See "Inventory Procedures" for an explanation of growth estimates and the actual periods over which growth was measured.*

[2] *Negative growth is the result of annual mortality exceeding gross annual growth.*

[3] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 33.—Net annual growth of sawtimber on commercial forest land, by species and county, central Washington, January 1, 1968[1] (Scribner rule)

(In thousand board feet)

Species	All counties	Chelan-Douglas	Kittitas	Klickitat	Okanogan	Yakima
Softwoods:						
Douglas-fir	196,400	43,800	48,900	30,000	56,700	17,000
True firs	118,000	19,500	22,900	12,900	5,700	57,000
Western larch	-21,000[2]	100	1,300	—	-4,700[2]	-17,000[2]
Ponderosa pine	129,100	23,600	8,700	28,000	27,400	41,400
Lodgepole pine	18,600	1,700	1,700	1,200	6,000	8,000
Other pines	3,000	1,200	-2,700[2]	—	300	4,200
Engelmann spruce	30,500	300	2,700	—	26,400	1,100
Cedars	5,100	2,100	1,200	500	100	1,200
Hemlock	13,400	4,600	5,100	-900[2]	—	4,600
Total softwoods	493,100	96,900	89,800	71,700	117,900	116,800
Hardwoods[3]	2,500	—	400	—	1,300	800
All species	495,600	96,900	90,200	71,700	119,200	117,600

[1] *See "Inventory Procedures" for an explanation of growth estimates and the actual periods over which growth was measured.*

[2] *Negative growth is the result of annual mortality exceeding gross annual growth.*

[3] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 34.—Average annual mortality of growing stock on commercial forest land, by species and ownership class, central Washington, January 1, 1968[1]

(In thousand cubic feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	21,300	10,400	7,600	1,000	2,300
True firs	15,200	6,300	5,300	1,800	1,800
Western larch	9,800	2,700	5,800	100	1,200
Ponderosa pine	14,300	3,100	6,600	2,300	2,300
Lodgepole pine	7,500	3,500	3,300	700	—
Other pines	1,900	1,100	100	—	700
Engelmann spruce	3,100	1,500	600	700	300
Cedars	100	100	—	—	—
Hemlock	1,600	1,300	100	—	200
Total softwoods	74,800	30,000	29,400	6,600	8,800
Hardwoods[2]	400	100	200	—	100
All species	75,200	30,100	29,600	6,600	8,900

[1] *See "Inventory Procedures" for details on the mortality estimates and periods over which mortality was estimated.*

[2] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 35.—Average annual mortality of sawtimber on commercial forest land, by species and ownership class, central Washington, January 1, 1968[1] (International ¼-inch rule)

(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	106,900	53,400	38,100	5,500	9,900
True firs	66,700	27,100	22,400	8,100	9,100
Western larch	49,800	14,400	28,900	400	6,100
Ponderosa pine	67,100	19,300	26,300	12,800	8,700
Lodgepole pine	18,100	5,500	10,100	2,500	—
Other pines	9,900	6,100	—	—	3,800
Engelmann spruce	13,500	7,800	2,400	3,300	—
Cedars	400	400	—	—	—
Hemlock	9,600	7,400	1,000	—	1,200
Total softwoods	342,000	141,400	129,200	32,600	38,800
Hardwoods[2]	700	100	—	—	600
All species	342,700	141,500	129,200	32,600	39,400

[1] *See "Inventory Procedures" for details on the mortality estimates and periods over which mortality was estimated.*

[2] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 36.—Average annual mortality of sawtimber on commercial forest land, by species and ownership class, central Washington, January 1, 1968[1] (Scribner rule)

(In thousand board feet)

Species	All ownerships	National Forest	Other public	Forest industry	Farmer and miscellaneous private
Softwoods:					
Douglas-fir	94,300	46,500	34,000	5,000	8,800
True firs	57,100	23,500	19,200	6,700	7,700
Western larch	44,200	13,900	24,300	300	5,700
Ponderosa pine	61,000	18,500	23,200	11,200	8,100
Lodgepole pine	15,000	4,400	8,500	2,100	—
Other pines	8,500	5,200	—	—	3,300
Engelmann spruce	12,300	7,200	2,100	3,000	—
Cedar	400	400	—	—	—
Hemlock	8,000	6,200	900	—	900
Total softwoods	300,800	125,800	112,200	28,300	34,500
Hardwoods[2]	700	100	—	—	600
All species	301,500	125,900	112,200	28,300	35,100

[1] *See "Inventory Procedures" for details on the mortality estimates and periods over which mortality was estimated.*

[2] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 37.—Average annual mortality of growing stock on commercial forest land by species and county, central Washington, January 1, 1968[1]

(In thousand cubic feet)

Species	All counties	Chelan-Douglas	Kittitas	Klickitat	Okanogan	Yakima
Softwoods:						
Douglas-fir	21,300	3,200	2,700	3,000	8,000	4,400
True firs	15,200	4,900	3,100	1,600	1,200	4,400
Western larch	9,800	300	600	—	3,600	5,300
Ponderosa pine	14,300	1,200	2,200	2,900	3,000	5,000
Lodgepole pine	7,500	2,900	400	300	1,900	2,000
Other pines	1,900	700	1,100	—	—	100
Engelmann spruce	3,100	1,000	100	—	1,000	1,000
Cedars	100	—	—	—	—	100
Hemlock	1,600	100	800	100	—	600
Total softwoods	74,800	14,300	11,000	7,900	18,700	22,900
Hardwoods[2]	400	100	—	—	300	—
All species	75,200	14,400	11,000	7,900	19,000	22,900

[1] *See "Inventory Procedures" for details on the mortality estimates and periods over which mortality was estimated.*

[2] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 38.—Average annual mortality of sawtimber on commercial forest land by species and county, central Washington, January 1, 1968[1] (International ¼-inch rule)

(In thousand board feet)

Species	All counties	Chelan-Douglas	Kittitas	Klickitat	Okanogan	Yakima
Softwoods:						
Douglas-fir	106,900	15,100	13,300	16,600	37,200	24,700
True firs	66,700	21,800	14,500	7,000	4,000	19,400
Western larch	49,800	1,500	3,300	—	16,800	28,200
Ponderosa pine	67,100	6,300	11,700	11,900	17,700	19,500
Lodgepole pine	18,100	10,300	600	400	1,700	5,100
Other pines	9,900	3,900	5,700	—	200	100
Engelmann spruce	13,500	4,700	400	—	2,800	5,600
Cedars	400	—	100	—	—	300
Hemlock	9,600	100	5,300	1,000	—	3,200
Total softwoods	342,000	63,700	54,900	36,900	80,400	106,100
Hardwoods[2]	700	—	—	100	600	—
All species	342,700	63,700	54,900	37,000	81,000	106,100

[1] *See "Inventory Procedures" for details on the mortality estimates and periods over which mortality was estimated.*

[2] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 39.—Average annual mortality of sawtimber on commercial forest land by species and county, central Washington, January 1, 1968[1] (Scribner rule)

(In thousand board feet)

Species	All counties	Chelan-Douglas	Kittitas	Klickitat	Okanogan	Yakima
Softwoods:						
Douglas-fir	94,300	13,900	12,200	14,600	31,100	22,500
True firs	57,100	18,600	12,900	5,800	3,600	16,200
Western larch	44,200	1,200	2,900	—	15,900	24,200
Ponderosa pine	61,000	6,000	10,800	10,700	15,700	17,800
Lodgepole pine	15,000	8,700	500	400	1,400	4,000
Other pines	8,500	3,300	5,000	—	100	100
Engelmann spruce	12,300	4,300	400	—	2,700	4,900
Cedars	400	—	100	—	—	300
Hemlock	8,000	100	4,500	900	—	2,500
Total softwoods	300,800	56,100	49,300	32,400	70,500	92,500
Hardwoods[2]	700	—	—	100	600	—
All species	301,500	56,100	49,300	32,500	71,100	92,500

[1] *See "Inventory Procedures" for details on the mortality estimates and periods over which mortality was estimated.*

[2] *Consists primarily of black cottonwood and quaking aspen; also includes small amounts of red alder, western paper birch, bigleaf maple, and white alder.*

Table 40. — Average annual mortality of growing stock and sawtimber on commercial forest land, by cause of death and by softwoods and hardwoods, central Washington, January 1, 1968

Species	All causes	Fire	Insects	Disease	Weather	Miscellaneous	Unknown
			Thousand cubic feet				
Growing stock:							
Softwoods	74,700	3,000	8,500	17,700	5,800	12,700	27,000
Hardwoods	500	100	100	—	—	100	200
Total	75,200	3,100	8,600	17,700	5,800	12,800	27,200
			Thousand board feet, International ¼-inch rule				
Sawtimber:							
Softwoods	342,000	14,200	41,200	87,500	28,500	50,000	120,600
Hardwoods	700	—	600	—	—	100	'8
Total	342,700	14,200	41,800	87,500	28,500	50,100	120,600
			Thousand board feet, Scribner rule				
Sawtimber:							
Softwoods	300,800	12,800	36,800	76,000	24,700	43,400	107,100
Hardwoods	700	—	600	—	—	100	—
Total	301,500	12,800	37,400	76,000	24,700	43,500	107,100

Table 41.—Net volume of salvable dead sawtimber on commercial forest land, by volume-per-acre class and by county, central Washington, January 1, 1968

Volume-per-acre class	Total	Chelan-Douglas	Kittitas	Klickitat	Okanogan	Yakima
	Thousand cubic feet					
1-199	72,500	9,400	16,800	7,800	18,700	19,800
200-499	112,900	21,900	22,600	12,100	16,400	39,900
500-999	60,900	9,500	7,500	—	11,700	32,200
1,000-1,999	46,500	21,900	20,000	—	800	3,800
2,000 or more	—	—	—	—	—	—
Total	292,800	62,700	66,900	19,900	47,600	95,700
	Thousand board feet, International ¼-inch rule					
1-499	92,700	10,700	3,200	22,400	21,100	35,300
500-999	243,100	38,000	38,400	47,900	62,300	56,500
1,000-2,499	552,300	107,700	91,000	95,000	87,700	170,900
2,500-4,999	433,600	76,300	40,300	50,700	66,300	200,000
5,000-9,999	309,500	129,400	45,100	25,500	23,600	85,900
10,000 or more	14,000	—	—	—	—	14,000
Total	1,645,200	362,100	218,000	241,500	261,000	562,600

Table 42. — Net volume of salvable dead sawtimber on commercial forest land, by volume-per-tree class and species group, central Washington, January 1, 1968

Volume-per-tree class	Total	Douglas-fir	True firs	Pines	Other softwoods	Hardwoods
	Thousand cubic feet					
1-49	101,700	22,900	24,900	25,000	28,400	500
50-99	76,500	21,200	22,200	18,600	14,500	—
100-499	112,000	42,400	12,500	26,800	30,300	—
500 or more	2,600	1,400	600	—	600	—
Total	292,800	87,900	60,200	70,400	73,800	500
	Thousand board feet, International ¼-inch rule					
1-149	238,700	55,000	44,800	73,300	62,700	2,900
150-499	602,800	148,800	168,000	125,600	160,400	—
500-2,499	773,800	303,500	93,700	187,000	189,600	—
2,500 or more	29,900	8,700	4,300	8,200	8,700	—
Total	1,645,200	516,000	310,800	394,100	421,400	2,900

Table 43. — Timber harvest by ownership class, central Washington, 1952-68 (International 1/4-inch scale)

(In thousand board feet)

Year	All ownerships			Private[1]			State[1]			National Forest			Other public		
	Total	Live	Dead[2]	Total	Live	Dead[2]	Total	Live	Dead[2]	Total	Live	Dead[2]	Total	Live	Dead[2]
1952	453,633	446,043	7,590	—	—	—	257,058	257,058	—	119,305	113,630	5,675	77,270	75,355	1,915
1953	537,414	([3])	([3])	—	—	—	255,200	250,098	5,102	176,657	([4])	([4])	105,557	105,557	—
1954	509,849	490,012	19,837	—	—	—	249,783	241,583	8,200	164,994	153,652	11,342	95,072	94,777	295
1955	510,921	491,128	19,793	248,343	246,617	1,726	35,739	35,629	110	131,462	113,531	17,931	95,377	95,351	26
1956	491,251	481,406	9,845	185,434	183,445	1,989	34,000	33,634	366	162,533	155,043	7,490	109,284	109,284	—
1957	507,714	498,785	8,929	218,435	217,039	1,396	30,892	30,838	54	170,487	163,048	7,439	87,900	87,860	40
1958	489,677	478,993	10,684	185,202	183,764	1,438	19,446	19,037	409	179,901	171,064	8,837	105,128	105,128	—
1959	562,543	547,375	15,168	181,429	179,797	1,632	20,839	20,813	26	253,043	240,294	12,749	107,232	106,471	761
1960	567,252	555,067	12,185	254,543	251,724	2,819	15,039	14,692	347	210,477	202,688	7,789	87,193	85,963	1,230
1961	533,171	513,163	20,008	213,433	211,605	1,828	16,396	14,731	1,665	200,954	194,743	6,211	102,388	92,084	10,304
1962	579,440	573,978	5,462	155,634	154,817	817	25,630	25,261	369	293,822	289,756	4,066	104,354	104,144	210
1963	607,730	599,727	8,003	178,898	177,831	1,067	32,553	32,486	67	273,064	267,393	5,671	123,215	122,017	1,198
1964	697,069	688,798	8,271	191,331	190,928	403	27,523	27,523	—	310,193	302,736	7,457	168,022	167,611	411
1965	727,122	720,694	6,428	168,808	168,808	-	53,923	53,616	307	325,280	319,181	6,099	179,111	179,089	22
1966	704,897	700,929	3,968	153,186	151,676	1,510	58,100	58,093	7	308,598	307,207	1,391	185,013	183,953	1,060
1967	741,243	730,547	10,696	165,312	165,232	80	54,672	54,365	307	314,473	305,729	8,744	206,786	205,221	1,565
1968	790,247	778,500	11,747	178,948	178,870	78	62,965	62,808	157	344,418	336,184	8,234	203,916	200,638	3,278

[1] *Data for State and private ownership for 1952-54 were not separated.*

[2] *Includes snags and down material existing before initial logging. Salvage of this material does not constitute a drain on the volume of the forest inventory of live trees.*

[3] *Incomplete data.*

[4] *Data not available by live and dead.*

RELIABILITY OF FOREST RESOURCE ESTIMATES

Forest land area and timber volume

The estimates of forest land area and timber volume in central Washington were derived by sampling and thus have sampling errors. Sampling errors have been computed for the estimates of commercial forest land area, noncommercial forest land area, net cubic-foot volume of growing stock, and net board-foot volume (International ¼-inch rule) of sawtimber. These sampling errors are presented in table 44 as a percent of the estimated total at the 68-percent and 95-percent probability levels. They may be interpreted as meaning that the odds are two out of three for 68-percent probability, or 19 out of 20 for 95-percent probability, that the ranges shown include the true value (i.e., the results of a 100-percent inventory). For example, we can expect, with 95-percent confidence, that the estimate of total commercial forest land area—4,370,000 acres ±2.4 percent (104,880 acres)—includes the true value.

In addition to measurable sampling errors, there may be other nonsampling errors due to mistakes in judgment, measurement, and compilation. The magnitude of errors of this nature cannot be determined. However, such errors are kept to a minimum through training, supervision, field checking, and complete editing and machine verification in compiling the data.

The sampling error of any breakdown of these totals will be substantially greater than for the total. The smaller the breakdown, the larger the sampling error. An approximation of the increasing sampling error can be obtained from table 45, which shows the sampling error associated with smaller estimates.

Table 44. — Sampling errors of estimate of forest area and timber volume, central Washington, January 1, 1968

Item	Estimated total	Sampling error in percent	
		68-percent probability	95-percent probability
Commercial forest land	4,370,000 acres	±1.2	±2.4
Noncommercial forest land	844,000 acres	±4.4	±8.6
Volume:			
Growing stock	10,974 million cubic feet	±1.9	±3.7
Sawtimber (International ¼-inch rule)	50,909 million board feet	±2.4	±4.7

Table 45. — Approximate sampling error by size of estimate, central Washington, January 1, 1968

Commercial forest land		Growing stock		Sawtimber	
Area	Sampling error[1]	Volume	Sampling error[1]	Volume	Sampling error[1]
Thousand acres	*Percent*	*Million cubic feet*	*Percent*	*Million board feet*[2]	*Percent*
4,370	1.2	10,974	1.9		
1,573	2.0	9,904	2.0	50,909	2.4
699	3.0	4,402	3.0	32,582	3.0
393	4.0	2,476	4.0	18,327	4.0
252	5.0	1,585	5.0	11,729	5.0
63	10.0	396	10.0	2,932	10.0
28	15.0	176	15.0	1,303	15.0
16	20.0	99	20.0	733	20.0
10	25.0	63	25.0	469	25.0
7	30.0	44	30.0	326	30.0
		25	40.0	183	40.0
		16	50.0	117	50.0
		4	100.0	29	100.0

[1] *By random sampling; 68-percent probability.*

[2] *International ¼-inch rule.*

INVENTORY PROCEDURES

The summary tables in this report include data from the inventories of the Gifford Pinchot, Okanogan, Snoqualmie, and Wenatchee National Forests, conducted by the Division of Timber Management, Region 6, U.S. Forest Service, and data from the inventory of lands outside the National Forests, conducted by the Forest Survey project, Pacific Northwest Forest and Range Experiment Station. National Forest lands were inventoried in 1964-66, except the Gifford Pinchot which was done in 1969. Land outside the National Forest was inventoried in 1967. No updating was done to bring data to a common date. The same general standards and definitions were used for both National Forests and lands outside the National Forests, except as explained in the following paragraphs.

National Forest lands

Field plots were distributed on a systematic grid at 1.7-mile intervals on National Forest lands.

On the Okanogan National Forest, field plots consisted of three ⅕-acre subplots located 6 chains apart, which were permanently established during 1957-59. The current data are based on the 1965-66 remeasurement of these plots.

All field plots on the Wenatchee National Forest consisted of three ⅕-acre subplots located 6 chains apart. Permanent ⅕-acre subplots were established in 1957-58 in the northern portion of the forest (the old Chelan and Entiat Working Circles) but not on the southern portion (Wenatchee and Ellensburg Working Circles). The current inventory data are based on the 1964-65 remeasurement of the ⅕-acre subplots established in the northern portion in 1957-58, and on new ⅕-acre subplots established in the southern portion in 1964 and 1965.

The fieldwork on the portion of the Snoqualmie National Forest in central Washington (Naches-Tieton Working Circle) consisted of three ⅕-acre subplots spaced 6 chains apart. These plots were permanently established in 1964. The current inventory data are based on these new ⅕-acre subplots.

For that part of the Gifford Pinchot National Forest in central Washington, the field plots consisted of 10 sample points distributed systematically over an acre. The variable-radius plot sampling principle was used at each point to select the trees to be tallied. Where no trees were tallied, a ground cover class was recorded. Summations of the 10-point tally expressed the timber resources and conditions for that acre and were used to estimate forest area and volume.

Growth estimates for the National Forests were based on data from the remeasurement of trees on the ⅕-acre subplots and from increment borings.

Estimates of annual mortality were based on (1) the tally of dead trees previously recorded as live on the ⅕-acre subplots originally established during 1957-59, and (2) the tally of dead trees estimated to have died within the past 5 years from the date of the inventory on the newly established plots.

Lands outside National Forests

A double sampling design was used for lands outside the National Forests. In the first stage, aerial photo sample plots were distributed systematically across the area. Photo plots were classified into one of three

major land classes—commercial forest, noncommercial forest, and nonforest—and the commercial forest plots were further classified into stand volume classes. All photo plots were classified by kind of owner from public records. Approximately 11,000 photo plots were examined. The second stage consisted of a basic systematic grid of field plots 3.4 miles apart with supplemental plots added. A total of 804 field plots were established at photo plot locations. Plots consisted of 10 sample points distributed systematically over an acre. The plot procedures used were the same as previously described for the Gifford Pinchot National Forest.

In addition to the two-stage sample using 10-point variable radius plots, previously established ⅕-acre plots were remeasured in Okanogan and Wenatchee Counties. The remeasured data were used to develop multiple regression equations of diameter growth, which in turn were used to estimate diameter 1 year ago for all trees on the 10-point variable-radius inventory plots. Net volume was computed for both past and present diameters, and gross growth was obtained by subtracting past from present net volume. Variables in the regression equations included d.b.h., average stand diameter, basal area per acre, tree age, crown ratio, site index, and combinations of these.

In Okanogan and Wenatchee Counties, annual mortality estimates are based on the tally of dead trees recorded as live on the originally established ⅕-acre subplots. For the other counties, where remeasurement was not possible, the procedures used were the same as previously described for the National Forests.

Timber harvest

The timber harvest figures used in this report have been obtained from various agencies using varying standards and methods of reporting. These timber cut figures are therefore not strictly comparable with Forest Survey's commercial forest land, volume, and growth data, but they are considered adequate for the analyses made.

DEFINITION OF TERMS

Land Area

Total Land Area

Includes dry land and land temporarily or partially covered by water, such as marshes, swamps, and river flood plains; streams, sloughs, and canals less than one-eighth mile wide; and lakes, reservoirs, and ponds less than 40 acres in area.

Forest Land Area

Land at least 16.7 percent stocked by trees of any size, or formerly having such tree cover, and not currently developed for nonforest use. Minimum area of forest land recognized is 1 acre.

Nonforest Land Area

Land that has never supported forests and lands formerly forested where use for timber management is precluded by development for other uses. Included are areas used for agricultural crops, improved pasture, residential areas, city parks, improved roads of any width and right-of-way clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and other nonforest strips must be more than 120 feet wide and clearings, etc., more than 1 acre in size, to qualify as nonforest land.

Forest Land Classes

Commercial Forest Land Area

Forest land which is producing or capable of producing industrial wood and not withdrawn from timber utilization.

Noncommercial Forest Land Area

Unproductive forest land incapable of yielding crops of industrial wood because of adverse site conditions, and productive public forest land withdrawn from commercial timber use through statute or administrative regulation.

Productive-reserved.—Public forest land withdrawn from timber utilization through statute, ordinance, or administrative order, but which otherwise qualified as commercial forest land. Also included are forest lands managed exclusively for Christmas tree production.

Unproductive.—Forest land incapable of yielding crops of industrial wood products because of adverse site conditions such as sterile soil, poor drainage, high elevation, steepness, and rockiness.

Forest Types

Forest types are determined on the basis of species plurality of all live trees that contribute to stocking, considering both size and spacing.

Tree Classes

Growing-stock Trees

Sawtimber trees, poletimber trees, saplings, and seedlings; that is, all live trees except cull trees.

Sawtimber trees (11.0-inch d.b.h. and larger).—Live trees of commercial species. Softwood trees must contain at least one 12-foot saw log with a top diameter not less than 6 inches inside bark; hardwood trees must contain at least one 8-foot saw log with

a top diameter not less than 8 inches inside bark. At least 25 percent of the board-foot volume in a tree must be free of defect for either softwoods or hardwoods.

Poletimber trees (5.0- to 10.9-inch d.b.h.).—Live trees of commercial species not less than 50 percent sound on a cubic-foot basis and with no disease, defects, or deformities which are likely to prevent their becoming growing-stock sawtimber trees.

Sapling and seedling trees (less than 5.0-inch d.b.h.).—Live trees of commercial species with no disease, defects, or deformities which are likely to prevent their becoming growing-stock poletimber trees.

Non-growing-stock Trees

Cull trees.—Trees of noncommercial species and trees of commercial species which are too defective or which are unlikely to become growing-stock trees due to deformity, disease, low vigor, etc.

Sound cull trees. Trees of noncommercial species or with excessive defect due to form, roughness, etc.

Rotten cull trees. Trees with excessive defect due primarily to rot.

Mortality trees.—Trees of commercial species which have died from natural causes within a specified period and which were not cull trees at the time of death.

Salvable dead trees.—Standing or down dead trees of commercial species 11.0 inches or more in diameter that contain 25 percent or more of sound volume and at least one merchantable 16-foot softwood log or one merchantable 8-foot hardwood log.

Stand-size Classes

Sawtimber Stand

Stand at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber and poletimber trees, and with sawtimber stocking equal to or greater than poletimber stocking.

Large sawtimber stand.—Stand in which the majority of the sawtimber stocking is in trees 21.0-inch d.b.h. and larger.

Small sawtimber stand.—Stand in which the majority of the sawtimber stocking is in trees from 11.0- to 20.9-inch d.b.h.

Poletimber Stand

Stand at least 16.7 percent stocked with growing-stock trees, with half or more of this stocking in sawtimber and poletimber trees, and with poletimber stocking exceeding sawtimber stocking.

Sapling and Seedling Stand

Stand at least 16.7 percent stocked with growing-stock trees, with more than half of this stocking in saplings and/or seedlings.

Nonstocked Area

An area of commercial forest land less than 16.7 percent stocked with growing-stock trees.

Stocking

Stocking is a means of expressing the extent to which growing space is effectively utilized by present or potential growing-stock trees of commercial species. "Percent of stocking," synonymous with "percentage of growing space occupied," is the ratio of actual stocking to full stocking for comparable sites and stands. Basal area is used as a basis for measuring stocking.

"Stocking percentages" express current area occupancy in relation to specified standards for full stocking based on number, size, and spacing of trees considered necessary to fully utilize the forest land.

Full utilization of the site is assumed to occur over a range of basal area. As an interim guide, 60 percent of the normal yield table values has been used to establish the lower limit of this range which represents full site occupancy. This is called 100-percent stocking. The upper limit to full stocking has been set at 132 percent. Sites with less than 100-percent stocking represent understocking with less than full site occupancy. Overstocking is characterized by sites that have over 132-percent stocking.

Age

Stand Age

Stand age is based upon growing-stock stocking. In order for a stand to be even-aged,

a majority of the growing-stock stocking must be in two adjacent age classes. Stands that do not meet this criterion are classified as uneven-aged.

Rotation Age

The period of years between establishment of a stand of timber and the time when it is considered ready for cutting. Rotation age in softwood stands is 120 years, except lodgepole pine which is 80 years; in hardwood stands, it is 50 years.

Old-growth Sawtimber Stand

Sawtimber stand in which 50 percent or more of the growing stock is in trees at least 140 years old.

Young-growth Sawtimber Stand

Sawtimber stand in which more than 50 percent of the growing stock is in trees less than 140 years old.

Timber Volume

Live Sawtimber Volume

Net volume in board feet of live sawtimber trees of commercial species. Net volume equals gross volume less deduction for rot, sweep, crook, and other defects that affect use for lumber.

Scribner rule.—The common board-foot log rule used in determining volume of sawtimber in Washington. Scribner volume in the central Washington area is measured in terms of 16-foot logs.

International ¼-inch rule.—The standard board-foot log rule adopted nationally by the Forest Service for the presentation of Forest Survey volume statistics.

Saw-log portion.—That part of the bole of sawtimber trees between the stump and the saw-log top.

Upper-stem portion.—That part of the bole of sawtimber trees above the saw-log top to a minimum top diameter of 4 inches outside bark or to the point where the central stem breaks into limbs.

Growing-stock Volume

Net volume in cubic feet of live sawtimber trees and live poletimber trees from stump to a minimum 4.0-inch top (of central stem) outside bark. Net volume equals gross volume less deduction for rot and missing bole sections.

All Timber Volume

Net volume in cubic feet of live and salvable dead sawtimber trees and poletimber trees of commercial species, and cull trees of all species from stump to a minimum 4.0-inch top outside bark.

Industrial Wood

All roundwood products, except fuelwood.

Net Annual Growth

The increase in net volume of a specified size class for a specific year. (Components of net annual growth include the increment in net volume of trees at the beginning of the specific year surviving to the year's end, plus net volume of trees reaching the size class during the year, minus the net volume of trees that died during the year, minus the net volume of trees that became culls during the year.)

Ownership Classes

National Forest Lands

Federal lands which have been designated by Executive order or statute as National Forest or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones title III lands.

Other Public Lands

Federal lands other than National Forests, including lands administered by the Bureau of Land Management, Bureau of Indian Affairs, and miscellaneous Federal agencies; and lands owned by States, counties, and local public agencies, or lands leased by these governmental units for more than 50 years.

Forest Industry Lands

Lands owned by companies or individuals operating wood-using plants.

Farmer-owned Lands

Lands owned by operators of farms.

Miscellaneous Private Lands

Privately owned other than forest industry or farmer-owned lands.

TREE SPECIES

Principal tree species found on the commercial forest land in the central Washington area include:

Softwoods:
Alaska-cedar (*Chamaecyparis nootkatensis*)
Douglas-fir (*Pseudotsuga menziesii*)
Engelmann spruce (*Picea engelmannii*)
Grand fir (*Abies grandis*)
Lodgepole pine (*Pinus contorta*)
Mountain hemlock (*Tsuga mertensiana*)
Noble fir (*Abies procera*)
Pacific silver fir (*Abies amabilis*)
Pacific yew (*Taxus brevifolia*)[1]
Ponderosa pine (*Pinus ponderosa*)
Subalpine fir (*Abies lasiocarpa*)
Western hemlock (*Tsuga heterophylla*)
Western juniper (*Juniperus occidentalis*)
Western larch (*Larix occidentalis*)
Western redcedar (*Thuja plicata*)
Western white pine (*Pinus monticola*)
Whitebark pine (*Pinus albicaulis*)[2]

Hardwoods:[3]
Bigleaf maple (*Acer macrophyllum*)
Black cottonwood (*Populus trichocarpa*)
Cherry (*Prunus* spp.)[1]
Crab apple (*Malus* spp.)[1]
Hawthorn (*Crataegus* spp.)[1]
Oregon white oak (*Quercus garryana*)[1]
Quaking aspen (*Populus tremuloides*)
Red alder (*Alnus rubra*)
Western paper birch (*Betula papyrifera* var. *commutata*)
Willow (*Salix* spp.)

[1] *Noncommercial species.*

[2] *Found only in high mountains near timberline, generally on noncommercial forest land.*

[3] *In the central Washington area, a number of "brush" species occasionally attain tree size. They were not tallied as trees on this survey. Included are:*

Cascara buckthorn (Rhamnus purshiana)
Elderberry (Sambucus *spp.*)
Indian plum (Osmaronia cerasiformus)
Ocean spray (Holodiscus discolor)
Rhododendron (Rhododendron *spp.*)
Douglas maple (Acer glabrum *var.* douglasii)
Mountain mahogany (Cercocarpus ledifolius)
Serviceberry (Amelanchier *spp.*)
Sitka alder (Alnus sinuata)
Vine maple (Acer circinatum)

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Howard, James O.
1973. The timber resources of central Washington. USDA Forest Serv. Resour. Bull. PNW-45, 68 p., illus. Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

This report presents the findings of the latest inventory of the timber resources of Chelan, Douglas, Kittitas, Klickitat, Okanogan, and Yakima Counties, Washington. Accompanying the tables of detailed forest area, volume, growth, and mortality statistics is an analysis of the present timber resource, with emphasis on conditions that affect present and future timber production.

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1. Providing safe and efficient technology for inventory, protection, and use of resources.
2. Development and evaluation of alternative methods and levels of resource management.
3. Achievement of optimum sustained resource productivity consistent with maintaining a high quality forest environment.

The area of research encompasses Oregon, Washington, Alaska, and, in some cases, California, Hawaii, the Western States, and the Nation. Results of the research will be made available promptly. Project headquarters are at:

Fairbanks, Alaska
Juneau, Alaska
Bend, Oregon
Corvallis, Oregon
La Grande, Oregon
Portland, Oregon
Olympia, Washington
Seattle, Washington
Wenatchee, Washington

Mailing address: *Pacific Northwest Forest and Range Experiment Station*
P.O. Box 3141
Portland, Oregon 97208

The FOREST SERVICE of the U. S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.